

Psychology

A Problem-Solving Approach

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PSYCHOLOGY:
A Problem-Solving Approach

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PSYCHOLOGY:

A Problem-Solving

Approach

DONALD M. JOHNSON
Michigan State University

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PSYCHOLOGY: A PROBLEM-SOLVING APPROACH

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Preface

The objectives for the student in the first course in psychology, when they are made explicit, can be grouped for the most part under two headings: knowledge of content and skill in the use of this knowledge. The content of the first course includes the facts, concepts, principles, and methods which are considered important for the beginning student. The intellectual skills which many hope will be acquired in the first course are commonly described as reasoning or problem-solving skills, such as analyzing complex situations in terms of psychological concepts, applying psychological principles to new situations, identifying the assumptions in statements about behavior, detecting psychological fallacies, and making valid inferences from psychological data. Some of the policies followed in preparing a textbook as a means toward these objectives can be briefly outlined.

In respect to content, the first course in psychology is fairly well standardized today, at least as well as most of the introductory courses in the college catalog. This book aims to teach the standard topics, as currently understood, but the differences in emphasis should be pointed out. Animal psychology, the history of the science, and schools of psychology receive little attention. Intellectual activities, language, and the personality of the normal adult are emphasized somewhat more than usual. There is no separate chapter on physiological psychology, but physiological concepts are introduced frequently throughout the book where they are most useful. Psychological statistics, likewise, does not have an isolated chapter, but quantitative concepts and methods are introduced in the text, the practice problems, and the classroom projects described in the *Teacher's Manual*. The aim is to give the student considerable elementary practice, so that by the end of the course he will be doing simple computations, interpreting percentile scores and correlation coefficients, and making quantitative inferences from tables and graphs with ease.

As psychological research increases in amount and depth, it is possible to correct the omissions and errors of the past by adding more information on each topic. The better approach, of course, is not addition but selection and reorganization. Instead of teaching the student Binet's conception of the IQ and the modern additions, it is better to teach him the modern conception at the outset. It is better to skip the ancient concept of fatigue and its inadequacies and start the student out with a modern concept of work that need not be immediately updated. Conceptual reorganizations achieved at advanced levels, as well as new facts, should be moved down to the elementary level as soon as possible.

In presenting this material the emphasis has been on integration, clarity, and repetition. The number of technical terms has been cut to the minimum necessary for understanding the standard topics, hence the glossary, listing the italicized terms, has only about 350 entries. These terms are used repeatedly so that the student can master them and apply them readily in new contexts. The notion of social class, for example, is introduced in connection with a brief description of the structure of our society, after which social-class differences in abilities, child training, personality, and mental illness are easily understood. This plan is based on the assumption that transfer is facilitated more by thorough learning of 350 items than by partial learning of a larger number, many of which would have only special application. Concepts that are not worth frequent repetition are seldom worth single mention in an introductory text. This plan requires an orderly arrangement of chapters, with the later chapters building on concepts and principles introduced in the early chapters. The kind of integration required, however, is not a system of psychology in the traditional sense, but a system for teaching psychology that will facilitate functional understanding and transfer.

In respect to the second objective, the development of skill in the application of psychological knowledge, this book makes use of the well-established principle that a large proportion of the student's time should be spent in an active problem-solving kind of study. Textbooks of psychological statistics follow this principle by using many practice problems, and the same strategy is followed in the present text. To implement this problem-solving approach to learning psychology and to develop the skills mentioned above, 820 diverse problems have been constructed and distributed throughout the book. Some, at the beginning, are easy fill-in items, intended to fixate partially learned concepts and to develop an active vocabulary. Some are common misconceptions to be evaluated. Others are harder, intended for practice in critical thinking and reasoning, including quantitative reasoning, about psychological problems. Many require the application of a principle to a new situation. These problems were written concurrently with the text

and frequently serve to develop minor principles or corollaries after the major principle has been presented. The author's experience with these open-book problems indicates that beginning students enjoy them and can soon learn to handle problems that are usually considered appropriate for more advanced courses, e.g., analysis of perceptual tasks, analysis of social situations, interpretation of the results of experiments, coding of responses to projective tests, scaling of attitude items, rating of personality traits, and detection of fallacies in statements about people. It is a reasonable hypothesis that study of these problems will prepare a student for advanced classes and for solving psychological problems outside the classroom better than conventional methods of study.

These practice problems may be used in several ways. They may merely be recommended to the students as aids to study and self-examination. They may be done in class or assigned to be done outside and brought into class for grading and for discussion. It is desirable to answer them on a separate sheet rather than to mark up the book. Half may be assigned for homework and the other half used for quizzes. Those teachers who have to handle large classes without much time for individual participation may find that the time-honored method of exchanging papers with other students and grading them has many advantages.

The *Teacher's Manual* accompanying this text contains four types of teaching aids: answers to the practice problems; classroom projects, experiments, and demonstrations; a large supply of test items; and an inventory for collecting student opinions.

In the preparation of this book I am much indebted to my colleagues at Michigan State who have listened to my schemes and have made specific suggestions in their special areas. I am indebted also to those graduate teaching assistants and instructors of several years who have been involved with me in teaching, discussing, and trying to improve the first course, and who have helped to keep me from straying too far from the abilities, interests, and high hopes of students and teachers.

More specifically, I would like to thank the MSU Information Service for several photographs from their files. McGraw-Hill Book Company kindly permitted the use of several illustrations from an earlier text. Professors Paul Bakan and Terry Allen generously loaned photographs. I am indebted to Mr. Thomas Trabasso for a critical review of the practice problems. Most of the typing was done by Mrs. Mary Falcsik.

DONALD M. JOHNSON

PSYCHOLOGY:
A Problem-Solving Approach



Information Services, Michigan State University

Chapter 1. THE FRAMEWORK OF MODERN PSYCHOLOGY

Psychologists usually define their field as the science that studies behavior. They study the behavior of all animals, but this book is concerned primarily with human beings. The first chapter introduces some elementary notions that are essential for the remaining chapters.

The Facts of Psychology

The facts available for the study of behavior are of three general kinds, named according to the way they are obtained: behavior itself, physiology, consciousness.

Behavior. When a person stands up, sits down, blinks, gets a drink of water, or says "No," these are behavioral facts that anyone can observe directly. Some behavior is recorded with special equipment, as when the speed or amplitude of a blink is measured. Since people read, write, talk, and listen a lot, behavior involving words, called verbal behavior, is a large part of modern psychology.

Physiology. Bodily processes, such as a rise in blood pressure, are usually recorded by special apparatus. We are not interested in physiology for its own sake, but physiological facts are important for psychology when they help us understand behavior or consciousness.

Consciousness. Conscious experiences are thoughts and feelings that only the person himself is aware of, like feelings of embarrassment and sensations of warmth. Facts of consciousness are different from other kinds of facts because only the person himself can observe them. He may report to us what he feels when he inhales cigarette smoke, but all we know for sure is what he says. Scientifically a report of conscious experience is a special kind of verbal behavior. If Mr. A cuts himself and says "Ouch," the exclamation is behavior that anyone can observe. If Mr. B hears A say "Ouch," B usually

infers that A feels the same as B does when he says "Ouch." And if Mr. B says "I'm sorry," A may infer that B feels the same as A does when he says "I'm sorry." Under the best conditions, when two people speak the same language, and speak it frankly, inferences about consciousness from verbal behavior may be useful for psychology—as we shall see in later chapters. And we shall see also that people often do not speak frankly. When we are studying animals and infants, it is useless to ask about consciousness. We can imagine how they feel, but if they cannot talk, they cannot tell us.

Many of the terms used in psychology today originated long ago when the facts of consciousness seemed to be the most important facts. Thus many of the words we have now are more appropriate for describing conscious experience than for describing behavior or physiology. "Hunger" and "fear," to take two examples, are words that originally referred to consciousness and do not apply exactly to the accompanying behavior and physiology. Usually psychologists stretch the meanings of the old words so the new facts will fit under them but sometimes they use new terms, like "food-getting behavior" and "avoidance behavior."

Evidence about consciousness is called *subjective** since only the subject of the experience is aware of it. Evidence that is public, that anyone can observe, is called *objective*. Objective tests, for example, are tests that can be graded by anyone, even by a machine.

Preliminary Analysis

The complicated behavior of living beings cannot be studied all at once, so it is broken up into separate acts, reactions, movements, or *responses*, designated by R. Those may be numbered R₁, R₂, R₃, and so on, or they may be classified in some way, perhaps as cooperative R's and noncooperative R's or as conforming R's and nonconforming R's. When many R's are of the same class but differ in magnitude or intensity, e.g., responses of varying degrees of cooperativeness, the quality or dimension that they all have in common is called the *response variable*. Verbal R's can be classified in many ways, of course, either at the time they are made or later, as when someone studies the writings of Thomas Jefferson and classifies all the references to slavery. In later chapters we will discuss simple responses, like a movement of a finger, and complex response patterns, like signing your name and asking someone to dance. In general, we use R to stand for any response or pattern of responses that can be identified and differentiated from others.

One of the most prominent dimensions of behavior is the forward-back-

* To the student: Words in italics are standard terms that everyone studying psychology is expected to know. Most of these are defined more formally in the Glossary on pp. 555–570.

ward or for-against dimension. In many situations all we can observe about someone's behavior is that he is going toward something or avoiding it. Or, if we listen to his conversation, we may learn only that he is for something or against it. So we will find it useful to classify many R's simply as R+ and R-. Likewise, one of the most prominent dimensions of subjective experience is the pleasantness-unpleasantness dimension. When people talk about their feelings, many of their words express likes and dislikes. Hence verbal behavior can often be classified as R+ and R-. In general, with some exceptions, the subjective experience that goes along with R+ is pleasant and with R- unpleasant.

Having analyzed behavior into R's that can be identified and counted we are ready for the next task: to try to discover the factors that produce these R's. There are two broad classes of factors that influence behavior: factors or conditions in the organism, such as motives and attitudes, and factors in the environment, such as visual and auditory stimuli. Psychologists study the behavior of all organisms, as well as human beings, so the letter O is used for the organism or any identifiable condition within the organism, such as hunger and emotion. Collectively these internal conditions are known as *organismic variables*. The stimulus that elicits the response from the organism is designated as S. A response may be made to a simple little stimulus, like a light, or to a complex stimulus situation, like a roomful of people. In general, S refers to any *stimulus* or pattern of stimuli that can be identified and differentiated from others. When stimuli of the same kind, like sounds, vary in intensity or degree, the common dimension or quality of all of them is called a *stimulus variable*.

It may be easier to study these relationships if they are put in graphic form: $\begin{matrix} S \\ O \end{matrix} \rangle R$. This may be read: S and O combine to produce R. Or we may put these relationships in mathematical form: $R = f(O, S)$, which is read, R is a function of O and S. Or, R depends on O and S. When we want to influence behavior, we manipulate O, or S, or both. These are just skeleton expressions, oversimplified to be sure. The story will be filled in as we go along. There are many variations in procedure, but this is the framework on which modern psychology builds.

PRACTICE PROBLEMS

Fill in blanks 1-5 with S for stimulus or R for response.

Linda came home from school late, but her dog was waiting on the porch. When the dog saw Linda (1 _____), he ran and jumped on her (2 _____). Linda had an armful of books, so when she saw the dog (3 _____), coming at her, she jumped back quickly (4 _____), dropping her books (5 _____) on the sidewalk.

Fill in blanks 6–15 with B for visible behavior, P for physiological changes, or C for conscious experience.

Linda was annoyed at herself (6 _____) for dropping her books. She was embarrassed (7 _____) when she saw two boys across the road watching her and laughing. She tried not to notice. She calmly picked up her books (8 _____) but her hands were damp with perspiration (9 _____) and she dropped them again (10 ____). Now she was really angry (11 ____). Her face flushed (12 ____). Her heart beat faster (13 ____). "Down, Rover," she said (14 ____). One of the boys across the road whistled. Rover ran over to him, and Linda managed to pick up all her books at once (15 _____) and walk into the house.

16. Instead of writing $R = f(O, S)$, we can write $\text{Behavior} = f(P, E)$. What would you guess that P means?
17. What does E mean?
18. If we think of O as a machine, input is to output as S is to _____.
19. When we speak of successes and errors, are we classifying R's, O's, or S's?
20. Public is to private as objective is to _____.

From Facts to Theories

Like the other sciences psychology proceeds by accumulating terms, facts, and principles. Psychology has not invented many new terms, as chemistry has. Psychology has used the old terms, like "intelligence" and "hunger," that George Washington knew but has given them more precise meanings. The student will find that most of the words in psychology books sound familiar, but he will have to learn their new precise meanings. Not that it does any good in itself to learn words, but the words are necessary for communication of facts and principles. There is no use talking about intelligence, for example, unless you and your audience know what you mean by intelligence.

Psychologists have accumulated a lot of facts. It is a fact that the average woman gets a higher score on vocabulary tests than the average man. It is a fact that telephone numbers are quickly forgotten when they are not used. Many of these facts are interesting in themselves but their chief value is to prove principles.

Principles state relations between terms. One psychological principle states that aggression comes from frustration. To understand this principle one must know what aggression means and what frustration means. Another principle states that forgetting is a consequence of interference. Principles may be harder to learn than facts, but they are much more useful. A good principle can be applied to many facts in many situations, and if we know the principles, we can understand the behavior and predict what will happen next. If we know how the behavior depends on organismic variables and on stimulus variables, we can in some instances manipulate these vari-

ables and control the behavior. A good way to study psychology is to apply psychological principles to observed behavior. For example, when you see aggressive behavior, look for frustration.

One of the fascinating things about psychology today is that new principles are constantly being discovered. Psychology is young and it has a good start, so anyone who is 20 now and lives to 70 will live through the great developments of psychological science. These great discoveries will probably be made by people who are in college now.

Psychological investigations may begin in an exploratory way, with observations of people under various conditions and attempts to explain their behavior. One learns about aggression, for example, by describing this response pattern carefully and counting the instances that occur under different conditions and at different times of the day. Other investigations begin with a guess or a *hypothesis*, usually based on previous observations or theory. One may begin with the hypothesis that people become aggressive when they are frustrated, frustrate some, and count the aggressive responses that follow. An investigation organized around a hypothesis has the advantage that the relation between cause and effect, or the lack of such a relation, will usually be apparent.

Not only do psychologists construct hypotheses about relations between variables but they sometimes invent or construct variables. These are then called hypothetical variables or *constructs*. Habit is a good example. We cannot observe a habit, but we can observe the practice by which we assume a habit develops, we can arrange conditions under which a certain habit will be weak or strong, and we can observe the effects of habits on behavior. Thus we can use the construct of habit in a systematic and useful way. Other useful constructs are motive, intelligence, and personality trait. In fact most of the chapters of a psychology book are named for abstractions invented to explain behavior rather than for directly observed behavior.

A *theory* is a coherent organization of constructs and principles intended to explain a large number of facts, e.g., a theory of vision or a theory of emotion, and to direct research along these lines. A theory can be called a large-scale hypothesis, and progress in psychology, as in any other science, depends on facts of behavior and on theories about them. Facts are used to support or reject theories and to construct new theories. Theories are used to organize the facts and to plan the search for new facts.

Methods

Suppose we are interested in a certain kind of behavior—aggression, for example. We want to know who shows this kind of behavior and why. We

must first identify and describe this response so we will know what it is that we are investigating. Fortunately, when aggression is defined as a hostile or destructive response, intended to do harm, two different observers with a little training can agree fairly well in classifying responses as aggressive or nonaggressive. The people being observed or tested are called *subjects*.

Comparison of Groups. Once we have identified the response pattern that we are investigating and learned how to observe it or measure it, we can compare various groups to see what kind of people exhibit this behavior most often. We may find that girls show some behavior more than boys, or older people more than young people, or city people more than country people. Boys, for example, are more aggressive than girls in most comparisons. If we suspect that aggression is more common in certain types of families, we might do a city-wide survey, dividing the families into three or four types and counting the instances of aggression reported for the children in each type of family.

Comparing groups by a survey of this kind tells us where certain behavior patterns are to be found but does not tell us why. Psychologists often go farther and make up one group of highly aggressive boys and another group of nonaggressive boys, then study each group intensively in order to discover other differences between them. It may turn out that the two groups differ in number of childhood illnesses or in ability to read. If so, this difference supplies a hint about the origins of their behavior. Much of the information in the chapters on abilities and personality comes from comparisons between groups.

Psychological experiments. The best method for discovering principles, in psychology as in the other sciences, is the experimental method. The word "experiment" is often used loosely for any investigation that collects facts, but technically in an experiment the experimenter controls the conditions under which the behavior occurs so that he can observe the behavior accurately and the conditions leading up to it. For example, the experimenter might arrange ordinary conditions in an ordinary room and notice whether anyone becomes aggressive. Then he might change some variable—the temperature, the objects in the room, or what not—keeping other things constant, and watch to see whether the amount of aggression changes. It was discovered in one experiment that when people were frustrated the number of aggressive responses increased.

In scientific terms the behavior we are investigating is called the *dependent variable*. In a psychological experiment the dependent variable is usually a response variable, such as the number of aggressive responses. The experiment is arranged to permit observation of the organismic variables and stimulus variables on which this response depends. If we begin with a hypothesis that aggression depends on frustration, we hold the other condi-

tions constant and change the amount of frustration to see whether the amount of aggression changes. If the aggression changes when the frustration changes and does not change when the frustration does not change, we can be sure that the aggression depends on frustration. When we change the amount of frustration independent of other conditions, we call this the *independent variable*.

When we change the conditions by introducing an independent variable, like frustration, we often call such conditions the *experimental conditions*, and the conditions which have not been changed are called the *control conditions*. We observe the responses of our guinea pigs under experimental and control conditions and compare them to see if there is a difference due to the independent variable. Another common experimental design is to use two separate groups of subjects. Both groups are treated the same in all respects except that one group, called the *experimental group*, gets the independent variable, e.g., the frustration, while the *control group* does not. Then both groups are compared to see whether there is a difference due to the experimental variable.

Psychology is concerned not only with general principles that apply to all people but also with the differences between people, called *individual differences*. Everyone learns, but some learn more than others. Everyone becomes aggressive under certain conditions, but some become more aggressive than others. We observe individual differences by putting different people in a standard test situation where they all get the same stimuli and see which people learn most, which become most emotional, which give up first, and so on.

Like other sciences psychology expresses the results of research in several forms. Often the results are expressed in words: aggression is a consequence of frustration. Or the results may be expressed as a table of data showing the number of aggressive responses under different conditions. A third method is to draw a graph of the results, usually with the dependent variable on the vertical and the independent variable on the baseline. When the measurements are carefully made, the relationships between dependent and independent variables can be put into mathematical form and written as an equation or mathematical law. All four ways of presenting the facts and principles of psychology will be used in this book, but chiefly the first three.

PRACTICE PROBLEMS

Look ahead to Table 11.9 on p. 424 and mark the following statements T or F.

21. ____ According to the data in the table, intelligence of children is related to the occupation of their parents.

22. _____ The table shows that all children of businessmen are more intelligent than farmers' children.
23. _____ The data show that there are now more businessmen in the country than farmers.
24. _____ The evidence in the table comes from a controlled experiment.
25. _____ In making up the table it was necessary to group several different occupations together.
26. _____ The data show that the low scores of the day laborers are due largely to inferior education.
27. _____ The slightly skilled workers resemble the day laborers in intelligence more than they resemble the highly skilled workers.
28. _____ In general, the table states a theory of the development of intelligence.
29. _____ The facts under the heading "Adults" are independent of the facts under the heading "Children."

Look ahead to Fig. 11.1 on p. 391 and mark the following statements T or F.

30. _____ The dependent variable is the number of trials.
31. _____ One subject was consistently better than the other.
32. _____ The optimal amount of practice is about four days.
33. _____ The independent variable is the amount of practice.
34. _____ The average curve gives a fair picture of the progress of the two men.
35. _____ Both subjects made 65 correct responses before they quit.
36. _____ Both subjects improved rapidly at first, then slowed down.
37. _____ The data come from a controlled experiment.

Bodily Basis of Behavior

Most of the responses of interest to psychology are produced by muscles—muscles of the hands, the legs, the face, and above all of the mouth, larynx, tongue, and diaphragm that work together to make speech sounds. Glands should be mentioned also because the response to some stimuli may be a glandular secretion, such as saliva or tears. The nerves that go to these muscles and glands and touch off the responses at appropriate times are called *motor nerves*. Motor nerves also go to muscles that hold back or inhibit muscular responses, and this *inhibition* of response is equally important for the smooth performance of complex activities.

The parts of the body that receive stimuli from the environment are called *receptors*. Just as the muscles are specialized to make movements, the receptors in the sense organs are specialized cells that are sensitive to certain stimuli, such as lights, sounds, and smells. These receptors are closely associated with nerves, called *sensory nerves*, that convey information about the stimuli to the rest of the nervous system.

The sensory nerves do not communicate directly with the motor nerves. In between are connecting or integrating nerves. The simplest kind of response, a *reflex*, does not require much integration. Let us say that a hot

object touches the skin. Receptors in the skin start nervous signals over the sensory nerves to the connecting nerves. The connecting nerves relay signals over the motor nerves to the appropriate muscles, which then make an avoidance response. All this may require only a fifth of a second. It can be

graphed thus: $\begin{matrix} S_{\text{hot}} \\ O \end{matrix} \rightarrow R-$. Since this reflex will occur under nearly all conditions of the organism, we can leave out the O and write simply: $S_{\text{hot}}-R-$.

Most of the activities of complicated organisms like men and women are more complicated than reflexes. Responses made by one hand are coordinated with responses made by the other hand and perhaps both legs. Information coming from the skin is integrated with information coming from the eyes and other senses. The part of the body that does the integrating is the *central nervous system*, which includes the spinal cord and the brain (see Fig. 1.1). Nerve pathways conduct signals from the sensory nerves up to the brain and from the brain down to the motor nerves. Thus information about the environment coming from one sense organ is integrated with information coming from other sense organs and used to control the responses. If someone is driving a car, for example, his steering movements are responsive to information about the road coming from the eyes and to information about the position of the steering wheel coming from his fingers. If the steering wheel turns hard, this information feeds back to the brain and he makes a stronger turning response. If he turns too much or too little, this information from his eyes feeds back to the brain and the response is corrected. It is this *feedback* principle that enables a person to hold his behavior to a course or to track a moving target. These *pursuit movements*, continuously corrected, are more typical of human activity than are reflexes (see Fig. 1.2). A response is made to a stimulus: S_1-R_1 .

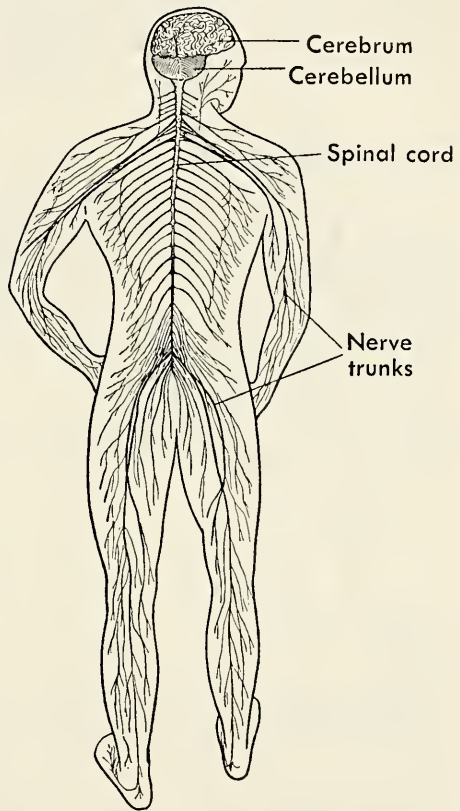


Fig. 1.1 Diagram of the central nervous system. (From C. W. Young, G. Ledyard Stebbins, and Clarence John Hylander, *Human organism and the world of life*, Harper, 1938)

Then information about R_1 is the stimulus for a corrective response, R_2 . In other words, a response can be a stimulus for another response or for inhibiting a response. The same feedback principle operates in the control of social behavior. We shall see in later chapters that people are always correcting or inhibiting their responses according to their effects on other people.

Usually the nervous system is prepared in advance of stimulation so the organism is tuned up to perceive certain stimuli rather than others and is

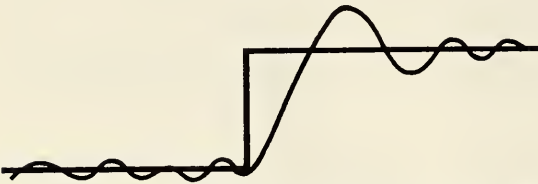


Fig. 1.2. Response to a moving stimulus. The heavy line shows the stimulus line or target, moving to the right, and the light line is the path traced by the subject trying to keep a pointer on the line though unable to see ahead. As the line shifts suddenly, the subject pursues it after a delay and overshoots but perceives his error and corrects for it. In most of our activities the response pattern is continuously adjusted by perception of previous responses.

ready for certain responses rather than others. This preparation of the organism is called the *set*. The sprinter at the starting line, for example, gets set to hear the starter's gun and to make a fast start. If he is not well set, his start will be slow. The timekeeper is set to hear the starter's gun and to press his stopwatch. We shall see in later

chapters that we need to know how a person is set before we can tell what response he will make to a stimulus. In this example, the sprinter, who is

set one way, will make one response to the stimulus, $\begin{matrix} S \\ \searrow \\ O_{set1} \end{matrix} \rangle R_1$ and the starter, who is set another way, will make a different response to the same stimulus,

$$\begin{matrix} S \\ \searrow \\ O_{set2} \end{matrix} \rangle R_2.$$

The brain itself is living tissue which has a rhythm or wave of its own that can be picked up by electrodes attached to the skull. Records of these electrical waves, called *electroencephalograms*, give an index of the level of activity of the cerebral cortex and perhaps of the whole organism. We shall see in the next chapter that the natural rhythm of the brain is interrupted by a change of set.

Outside the spinal column is another nervous system, the *autonomic nervous system*, which also integrates activities in different parts of the body (see Fig. 1.3). Nerves run from this system to many organs inside the body, so all of them can be stimulated at once, and it is this nervous system that touches off the widespread bodily changes during emotional excitement.

The human body of today is the result of thousands and thousands of years of evolution, and it is fairly well adapted to life on this earth. One

inherits his body, of course, from his ancestors, and the principles of heredity or *genetics* are the same for man as for the other animals. As a rule, tall parents have tall children and short parents have short children. There are

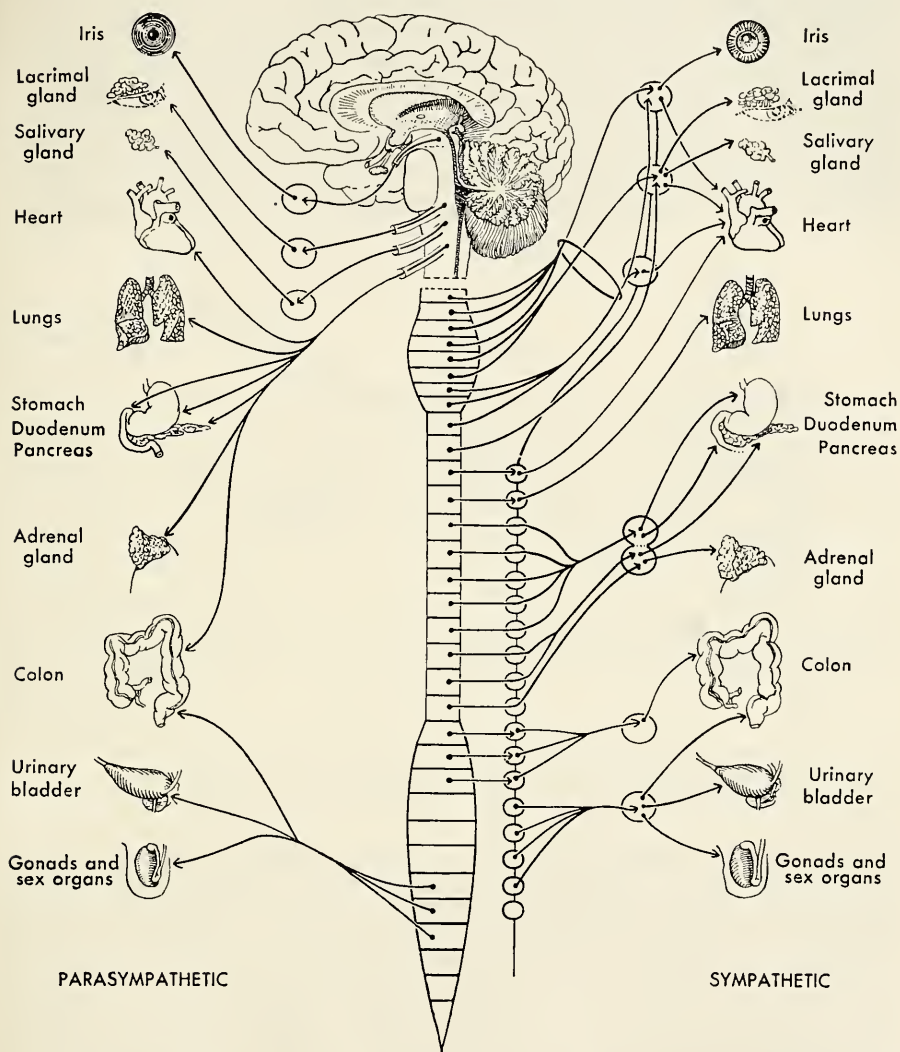


Fig. 1.3. Autonomic nervous system. (From W. Gordon Whaley, et al., *Principles of Biology*, 2nd ed., Harper & Brothers, 1958; modified from C. Donnell Turner, *General Endocrinology*, W. B. Saunders Company, 1948)

many exceptions, however, because human stock is not genetically pure. Tall parents usually have a few short ancestors from whom they inherit a few short genes to pass on to their children. Considerable evidence on the inheritance of individual differences in eye color, bodily deformities, and the like is available in college courses in human genetics. There is a little

evidence on the inheritance of psychological traits, particularly intelligence, to be mentioned later. As methods of measuring psychological traits improve and as records of these traits accumulate, we will probably learn more about the inheritance of important psychological traits.

The organism changes greatly as it grows from conception to birth, then to maturity, and on into old age. The differences, in body and behavior, between little Davey Stone, when he was six months old, and Mr. David L. Stone, sixty years later, are enormous. This massive development of the individual is due to two processes: learning and maturation. Learning to play the trumpet requires practice. Learning history requires study. Mr.



Fig. 1.4. Male and female growth curves. (From K. Simmons, *The Brush Foundation Study of Child Growth and Development. II. Physical growth and development*, *Monogr. Soc. Res. Child Developm.*, 1944, 9, No. 37)

David L. Stone is different from the young Davey he used to be largely because of the skills, information, attitudes, and social habits that he has learned. This important topic of learning will have two chapters to itself.

Mr. Stone is different from young Davey also because he is older. Any baby who lives a healthy life will grow bigger arms and legs, more teeth, more appetite, more strength and dexterity, longer attention span, and more intelligence. Growth curves for body weight are shown in Fig. 1.4. These changes do not require any special practice. They are consequences of growth or *maturation*. Maturation is a continuous and irreversible process, coextensive with life itself and relatively independent of outside stimulation. Birds grow wings and fly. Fish grow fins and swim. Children grow legs and walk. They do not have to take lessons in these skills as they do if they want to learn to play the trumpet. These are hereditary capacities that develop naturally when the organism reaches the proper stage of development. As we

shall see in later chapters, the bodily structures must be mature before we can learn to use them.

Man's abilities rise to a peak and then decline slowly, but not all at the same rate. Ability to breathe is mature shortly after birth. Ability to adjust to variations in temperature develops in a few months and seems to weaken slightly in old age. Ability to walk develops in about 14 months on the average. The senses, such as vision and hearing, reach top performance by age 10 or so and start to decline in the forties. Sexual functions develop slowly for 12 to 14 years, then rapidly reach the maximum, and gradually weaken. Chapter 11 will show how intellectual abilities increase for about 20 years and how aging affects speed of intellectual activities.

SUMMARY

The facts that psychology deals with are behavioral, physiological, and conscious facts, organized around the explanation of behavior. Behavior is analyzed into responses, simple or complex, and related to conditions within the organism and to stimulus variables in the environment. The facts of behavior are not so important, of course, or so interesting as principles and theories of behavior.

Psychology proceeds by comparing one group of people with another and by arranging experiments in which dependent variables can be clearly related to independent variables. Psychologists also observe individual subjects to get measures of individual differences.

The human body is organized so that information about the environment feeds through the sense organs and sensory nerves to the central nervous system, from which motor nerves lead out to the muscles, stimulating and inhibiting activity. Information about activity is fed back into the nervous system also so behavior is responsive to preceding responses. Usually the organism prepares a set for perception and response in advance of stimulation; hence behavior is a continuous pursuit rather than a series of reflexes.

Development of the individual throughout the life span is a matter of learning and maturation. Learning depends on practice or experience, while maturation is the progressive unfolding of hereditary assets and liabilities.

PRACTICE PROBLEMS

A little experiment was arranged to investigate the effects of a new drug, polybidol, on reading. A class of 50 college students agreed to participate and all took a reading test. On the basis of their scores they were assigned to Group A and Group B of 25 each, so that the two groups were equal in reading ability. Then everyone in both groups was given a pill. Group A received pills containing 5

grains of polybidol. Group B received pills that looked the same but contained no drug. After waiting 20 minutes all subjects took another reading test and filled out a blank describing their feelings. The experimenter calculated the average reading score for each group and the number of people in each group who reported such feelings as "tired," "fatigued," and "ready to quit," and the number who reported such feelings as "nervous," "jittery," and "on edge." The results are shown in the table below.

	Group A	Group B
Reading score	57.3	58.1
Feeling tired, etc.	5	12
Feeling nervous, etc.	7	2

From this description of the experiment mark the following statements T or F.

38. ____ The independent variable in this experiment is the drug.
39. ____ Group B is the control group.
40. ____ The table shows that both groups improved with practice.
41. ____ The table shows that the drug had no psychological effect.
42. ____ The chief effects of the drug are subjective.
43. ____ Technically this little investigation should not be called an experiment.
44. ____ The two bottom lines of the table are inconsistent.
45. ____ The report of feelings is a dependent variable.
46. ____ These reports of feelings are too personal to be useful for research.
47. ____ The results suggest that different dependent variables may be differentially affected by the same independent variable.
48. ____ The data show that the drug increased reading performance for some people and reduced it for others.
49. ____ The experiment shows that subjective evidence is not a dependable sign of objective performance.
50. ____ The groups were matched in advance on an organismic variable.

Fill in each blank with one of these terms: feedback, inhibit, motor nerve, receptor, response, sensory nerve, set, stimulus.

To test someone's reaction time the psychologist asks him to sit down at a table and adopt a 51 _____ to press a certain button when a light appears. In this case the light is the 52 _____, pressing the button is the 53 _____, and the time between the two is the reaction time. When the light hits the 54 _____, a nerve impulse travels along the 55 _____ to the brain. From the brain a signal travels over the 56 _____ to the muscle, which makes the response.

While the subject is 57 _____ for the next response, he holds his hand above the button ready to hit it. If the experimenter moves the button, the subject moves his hand along with it. He adjusts his movements according to 58 _____ from observation of his movements and the experimenter's movements. If he is efficiently 59 _____ to respond to a certain stimulus light when a stray light appears nearby, he will 60 _____ the prepared 61 _____.

62. Scientists have been impressed recently by similarities between machines and human beings. Which machine seems most human?

- a. One which can perform very complicated operations.
 - b. One which can respond to very small changes in the environment.
 - c. One which can respond to very weak stimuli in the environment.
 - d. One which can respond to the effects of its own actions.
63. Which word does not belong with the others: response, behavior, activity, habit, movement?

Classify each term as Ob for observable or Co for construct.

- | | |
|--------------------|--------------------|
| 64. _____ Response | 67. _____ Stimulus |
| 65. _____ Motive | 68. _____ IQ |
| 66. _____ Set | |

Discussion Questions

- A. Are all sciences experimental? Name a science that does not get its information from controlled experiments.
- B. Principles are harder to learn than facts. Which will be forgotten more quickly?
- C. The nervous system has often been compared to a telephone system. Is this a good analogy?
- D. Can an event within the organism be called S, instead of O?
- E. If you could know only one thing about a living human being, what would you want to know?
- F. "Any response that is not present at birth must be learned." Is this true?
- G. Do children *learn* to walk?

Recommended Reading

- T. G. Andrews. *Methods of psychology*. Wiley, 1948. Chapters on the methods used in research in the various fields of psychology, each written by an expert in that field. Many illustrations of apparatus, records, tests, materials, and typical results.
- L. Postman & J. P. Egan. *Experimental psychology*. Harper, 1949. An introduction to the procedures used in conducting psychological experiments. Instructions for laboratory experiments and treatment of results.
- R. S. Woodworth. *Contemporary schools of psychology*. Ronald, 1948. A short book, easy to read, telling how the problems of psychology have been considered from several points of view. Photographs of the psychologists mentioned in this textbook.
- G. Murphy. *Historical introduction to modern psychology*. Harcourt, Brace, 1949. Psychology may be young and venturesome, but it has its roots in the philosophy and science of the past. The later chapters can be read separately, in connection with the chapters of this textbook.
- B. B. Wolman. *Contemporary theories and systems in psychology*. Harper, 1960. A thorough, critical survey of current approaches to psychological research and theorizing. Behaviorism, psychoanalysis, Gestalt, field theory, and others are compared and evaluated.



Chapter 2. MOTIVATION: BASIC CONCEPTS AND PRINCIPLES

The flow of behavior is not continuous like the flow of a river. Behavior changes direction frequently, and intervals of gentle movement are interrupted by bursts of vigorous activity. We know that activity requires energy and that this energy is manufactured in the body by the combustion of food. But energy is not behavior. Our problem in this chapter is to explain how the potential energy in the body is transformed into activity. Thus this topic is called the dynamics of behavior or *psychodynamics* as well as motivation. There are two general questions for this chapter and the next. (1) *How is behavior aroused?* Why are people sometimes quiet, sometimes active, and sometimes highly excited? This is the question of arousal or activation of behavior. (2) *How is behavior directed?* Why do people turn one way rather than another? Why do they seek some objects or activities and avoid others? This is the question of the direction or control of behavior.

The behavior of the higher animals, including man, is motivated by several overlapping mechanisms, usually called reflexes, emotions, and drives. These traditional terms are hard to define because the mechanisms often work together, but each can be described in respect to the facts of behavior, physiology, and conscious experience. A good way to study the dynamics of behavior is to consider these primitive mechanisms first and see what they contribute to the activation and direction of behavior; the next chapter will consider how they are modified and how new dynamics are developed by civilized life.

Reflexes

The simplest pattern of action is a reflex, a localized response to a stimulus. It may be written: S-R. If your hand touches a hot radiator, you will pull it away. The withdrawal response is R; the hot radiator is S. Sneezing, cough-

ing, blinking, and the knee jerk are other reflexes. These are inherited; but conditioned reflexes, which we will study in Chapter 6, are learned by a special kind of training. The amount of activity involved in most reflexes is small, but in some, such as sneezing and coughing, considerable bodily activity is aroused.

Physiological aspects of a simple reflex are not extensive. The nervous system is involved, of course, and muscular tension and blood pressure may increase momentarily. Breathing may be interrupted. But these effects are all over quickly.

The reflex may or may not be consciously experienced. If the radiator is hot, you will be aware of a sensation of pain and you will be conscious of pulling your hand away. But you may make the response before you are aware of what you are doing. If a fly lights on your nose, you may brush it off without paying much attention to either the fly or the brush-off. If someone asks you about it a minute later, the memory of it may be gone. Other reflexes are not conscious at all, like the adjustment of the pupil of the eye to light.

The formula S-R is too simple because it leaves out the organism. The reflex depends chiefly on the stimulus, to be sure, but the condition of the organism influences the response also. If the subject is drowsy, the response will be slow, and one does not sneeze at all when asleep. If the subject anticipates the stimulus and is set to respond, the response may be faster, as when, after being burned on a radiator, he touches another. And, of course, he may be set to inhibit the reflex, as when he is groping for a pencil that dropped behind the hot radiator. So we should put the organism in the formula, but make it rather small to indicate that the stimulus is primary:



Emotions

Usually when we speak of emotions we mean such typical emotions as fear, anger, and joy. An emotional response is more widespread than a reflex. It involves the whole organism, whereas a reflex may be confined to a finger or an eyelid. It lasts longer than a reflex but not so long as one of the drives to be discussed later in this chapter. There are many emotions; the most distinctive feature of all of them is the amount of activity that bursts out. The direction of the activity is not so clear cut but usually can be classified as either approach or avoidant activity.

As an illustration of a typical emotion let us suppose that you are driving along the highway rather fast. A car comes toward you, on your side of the

road, apparently out of control. Probably the driver has fallen asleep. Your emotional responses can be described in respect to behavior, physiology, and consciousness. The behavior will consist of such responses as yelling, turning, and cringing. Physiological changes will stir up the whole organism. The conscious experience will be vivid; you will probably call it fear. Let us suppose that the other driver woke up in time, turned away, and missed you. The stimulus for the emotional response is gone, and you will probably return to normal in a few minutes.

For another common illustration, suppose you are walking down the street and you happen to meet an old friend whom you have not seen for some time. The behavior that follows may consist of talking, embracing or shaking hands, laughing and smiling. Physiological changes stir up the whole organism. The conscious experience will probably be called joy, or something similar. Soon you go your separate ways again, and the excitement subsides in a few minutes.

These intense emotions are very different from the ordinary calm condition. But we must also consider medium degrees of excitement only moderately different from calm, such as the mild thrill when you see your picture in the paper, the moderate anxiety when you are late for an appointment, and even the slight increase in tension that occurs when you are struggling with a mathematics problem. Now let us see how these emotions can be described in more detail.

Behavior. When a child is frightened, he is likely to yell and run. When he is angry, he may shout and start to fight. Similar defense activities can be observed in other animals. Dogs growl and bare their teeth. Cats spit and arch their backs. Fish dive for cover. Bees sting. Pleasant emotions in human beings often include laughing, smiling, and approaching the pleasing object. Likewise when you return home your dog may run and jump on you. Defense responses are the most frequently observed emotional activities in the wild animals, but among human beings laughing and smiling seem to be the most common. When the emotion is intense, almost anything can happen, and the behavior may be described as uncontrolled or disorganized.

The *startle pattern* is a primitive type of emotional behavior, somewhat more complex than most reflexes but not as complex as most emotions. It is a very rapid reaction of the whole body to a strong stimulus, such as a pistol shot, that is all over in half a minute. To get a good picture of the startle pattern high-speed movies are necessary.^{1*} Fig. 2.1 shows drawings made from the movies. The head jerks forward. The mouth pulls toward the corners. The eyes blink. The knees bend. This pattern cannot be completely inhibited. Policemen showed parts of the startle pattern in the high-speed movies even after many hours of target practice.

* Bibliographical information for all chapters is given on pp. 537-553.

Physiology. Since the most distinctive characteristic of emotions is the amount of activity aroused, physiological psychologists have investigated the whole range of activation or arousal, including complete relaxation, ordinary alertness to stimuli in the environment, mild tension, and extreme emotional excitement. The pattern of arousal includes internal physiological changes that are largely under the control of the *sympathetic division*

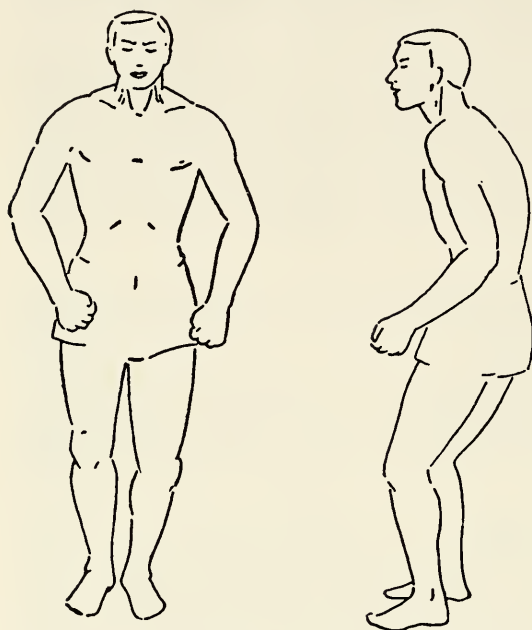


Fig. 2.1. The startle pattern. (From Landis & Hunt¹)

of the autonomic nervous system (see Fig. 1.3). Like the rest of the autonomic nervous system the sympathetic division operates with a certain amount of autonomy or independence from the central nervous system. But its chief feature is its unity. When a nervous signal travels along a motor nerve of the central nervous system, perhaps only a finger moves or an eyelid blinks. When the sympathetic nerves discharge, however, they go off all of a piece and produce widespread effects all over the body. Furthermore, sympathetic nerves go to the adrenal glands forcing them to discharge *adrenalin* into the blood. The adrenalin goes all over the body quickly and produces many effects that reinforce the effects of the sympathetic nerves. Between these two mechanisms of integration the whole body is stirred up. Blood pressure and heart rate increase. The pupils of the eyes grow wider. The saliva in the mouth thickens, so the mouth feels dry. Muscular tension increases. The muscles attached to hair on the skin sometimes contract, straightening the hair.

Adrenalin constricts the mucous membranes in the nasal passages, so if you have a head cold, a good scare may help you breathe. Adrenalin forces the liver to give up some of its stored sugar to the blood, which carries it to the muscles where it may be needed for energetic activity. Adrenalin also speeds up the kidney's elimination of waste products from the muscles. In case of a wound, adrenalin aids coagulation of the blood.

Sympathetic nerves also go to the stomach and small intestine, but here the effect of emotion is inhibitory. Digestive action is slowed down. When a

cat that has just been fed is examined by X-ray, the normal digestive movements can be seen, but then if the cat is excited by unfamiliar sounds or a pinch on the nose, these digestive movements stop for ten minutes or more.

Some of these physiological changes can be felt by the individual himself without the aid of any special apparatus. When 313 air-borne trainees practicing parachute jumps from a 34-foot tower were asked about such internal reactions, many reported nervousness, pounding heart, sweaty hands, and digestive symptoms.² The percentages are in Table 2.1.

TABLE 2.1. Physiological Reactions Reported by 313 Trainees Beginning Parachute Training by Jumping from a 34-Foot Tower

Reaction	Percentage
Hands trembled	15
Nervousness	38
Heart beat hard	30
Shortness of breath when not exercising	11
Hands sweating so they felt damp and clammy	24
Upset stomach	23
Cold sweats	9

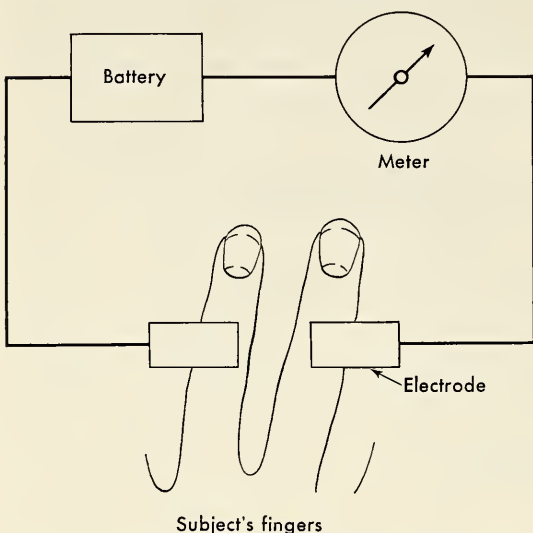
SOURCE: Walk.²

Other physiological changes can be recorded only with special apparatus, as in the case of blood pressure. Electrical signs of *muscular tension* can be picked up by electrodes attached to the skin over a muscle and, after amplification, used to drive a pen writing on a moving strip of paper. When any muscle contracts, as in moving an arm, considerable electrical activity is recorded, and when the muscle merely becomes tense, like the jaw muscles when the teeth are clenched, lesser amounts of electrical activity appear. During emotional excitement, even without observable movement, muscular tension increases, then subsides in a few minutes.

Another sensitive sign of the increase in activity level that goes along with emotion is the *galvanic skin response*, also called the psychogalvanic reflex. This is a decrease in the resistance of the skin to the passage of an electric current or, in other terms, an increase in the conductance of the skin. Two electrodes are fastened to the hand or two fingers are placed in liquid electrodes (see Fig. 2.2). The amount of current that flows from one electrode to the other depends on the conductance of the skin, and this conductance is measured by electrical instruments. When the subject is put under stress, as by painful stimuli, muscular strain, or embarrassing questions, the conductance of the skin rises, more current flows, and the needle of the galvanometer swings around. Or the electric current can be used to drive a pen

(see Fig. 2.3). The change in the conductance of the skin is due to changes in the sweat glands, which are under the control of the sympathetic nerves.

The electrical activity of the brain is also modified when the individual is aroused. The electroencephalogram of a normal subject under relaxed conditions



will usually show a fairly regular rhythm of about ten waves per second. If the subject is tense or apprehensive when he comes into the laboratory, the regular rhythm will not appear until he relaxes. In the relaxed condition, if he is now startled or alerted to lights and sounds in the environment, the lower brain centers activate the cortex for the reception of new environmental stimuli and the resting rhythm disappears.³

Fig. 2.2. Diagram to illustrate the galvanic skin response. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

The sympathetic part of the autonomic nervous system is not entirely autonomous; it is influenced by the lower brain centers, especially by the hypothalamus at the base of the brain. When the hypothalamus of a dog or a cat is damaged, the emotional responses are considerably altered. Electrical stimulation of the hypothalamus produces vigorous activity resembling rage.

The sympathetic part of the autonomic nervous system is not entirely autonomous; it is influenced by the lower brain centers, especially by the hypothalamus at the base of the brain. When the hypothalamus of a dog or a cat is damaged, the emotional responses are considerably altered. Electrical stimulation of the hypothalamus produces vigorous activity resembling rage.

Although everyone has an autonomic nervous system and everyone shows

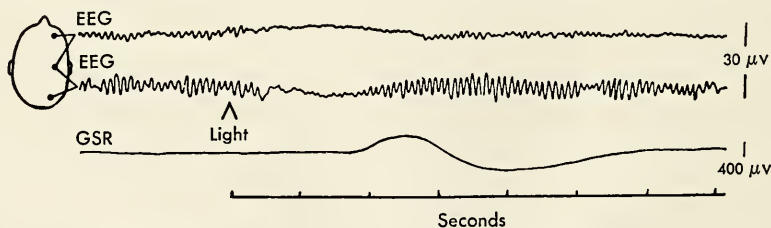


Fig. 2.3. Two electroencephalograms, one from the front of the head and one from the back. Reading from left to right the regular EEG rhythm shows first, before the light comes on. About two-fifths of a second after the subject is stimulated by the light, the regular rhythm in each EEG is blocked, but it reappears in a few seconds. The galvanic skin response, GSR, does not begin until about 1.5 seconds after the light. (By permission from D. B. Lindsley, *Emotions and the electroencephalogram*, in M. L. Reymert (Ed.), *The second international symposium on feelings and emotions*, copyright, 1950, McGraw-Hill Book Company, Inc.)

these physiological changes to some degree, there are individual differences in the pattern. When standard measurements are made in standard situations of stress, one person's greatest response may be the galvanic skin response, while another person's greatest response may be the increase in the heart rate. Furthermore these patterns are rather stable characteristics of the individual, for approximately the same pattern appears whether the stress is produced by doing mental arithmetic rapidly or by plunging a bare foot into icy water.⁴

Consciousness. Everyone who has lived in this world a while and has had the standard curriculum of love and hate, of success, failure, and narrow escapes knows how it feels to be emotionally aroused. It is difficult, however, to describe these feelings. People report feelings of warmth and cold, of tension and weakness, confusion, and peculiar stomach

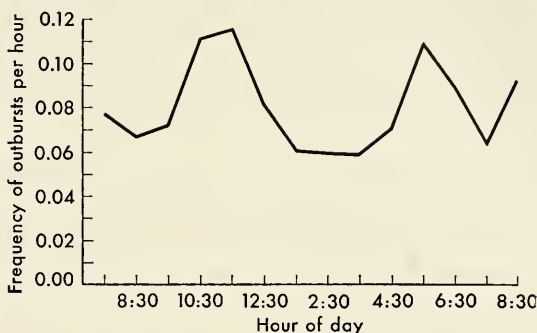


Fig. 2.4. Children's outbursts of anger in relation to time of day. The peaks occur before meals and before bedtime. (From Goodenough⁵)

sensations. As a rule, when the emotional behavior is directed toward the stimulating object, as when one pursues something, or eats something, or caresses someone, the accompanying conscious experience is described as pleasant. Likewise, when the emotional behavior is directed away from the stimulating object, as when one rejects food or avoids someone, the experience is felt as unpleasant. Psychologists have had some success in quantitative description of these feelings, as by the use of a rating scale.

Antecedents of Emotion. What kinds of events activate these emotional responses? Usually they are stimuli in the environment. A sudden stimulus, a loud sound that does not fit into a familiar pattern of sounds, loss of support, severe pain, or an intense light will cause startle and perhaps fear. Anticipation of such events may have almost the same effects. Sight of food brings joy to a hungry man, with the accompanying internal upset. A child who has just found his lost toy shows jumping-up-and-down joy all over.

But emotion is not entirely a response to external stimuli. Organismic variables are of some importance, as Fig. 2.4 shows. When one is tired, he will get angry with less provocation than when he is well rested. If he has been in pain all day, another small pain may produce a large emotional response. Physiological changes are part of the emotional response, but they are also organismic variables that influence the response to the next stimulus.

The basic level of activity, from which an emotion rises, exhibits a daily cycle. Most of the higher animals, including man, have their peaks of activity and alertness in the daytime, but some, like the rat and the bat, are more active at night. Some basic requirement of the complex nervous system of the higher animals imposes a cycle of activity and rest on our careers. Sleep inhibits emotion and emotion inhibits sleep.

Emotions are related also to the drives to be described later in this chapter. Satisfaction or anticipation of satisfaction of a drive produces joy. Frustration of a drive may lead to anger. Hence we must put O in the formula along with S. The O can be smaller to indicate that S is the primary deter-

minant. The R, of course, has three aspects.

$$\begin{array}{c} S \searrow \\ O \nearrow \end{array} R \left\{ \begin{array}{l} \text{behavior} \\ \text{physiology} \\ \text{consciousness} \end{array} \right.$$

In addition to these stimulus and organismic variables, almost anything can acquire emotional significance as a result of experience. In this sense it is correct to say that most emotions are learned, though we are speaking of the stimulus that arouses the emotion rather than the emotional response itself. On the response side most of the learning is learning to inhibit the response or to express it in a conventional way.

The Complete Pattern. Years ago, when man was considered a rational animal and psychology was the description of consciousness, it was supposed that the consciousness of the emotion came first. Then the excited person would consciously decide to fight, or to run. Today we know that the conscious experience is not the cause of the behavior or the physiological changes. It is altogether possible that a person becomes aware of an emotion when he gets feedback from the excited condition of his body. Instead of saying, "I run because I am afraid," one may say with equal logic, "I am afraid because I am running."

The complete pattern of emotion can be outlined, with much oversimplification, in the following sequence. When a situation is perceived as exciting, nervous signals from brain centers in and near the hypothalamus go down the spinal cord and out to the sympathetic nerves, discharging them and thus producing a large number of internal changes. Nerves also run from the brain centers to the skeletal muscles, touching off the running, the fighting, or the laughing. The consciousness of the emotion results from stimulation of the outer layers, or cortex, of the brain, either by the hypothalamus and other brain centers or indirectly by perception of the bodily upset. If emotional responses are inhibited, this inhibition apparently originates in the cortex, and damage to the cortex, by cutting off inhibition, may exaggerate emotional responses.

Recovery. When the stimulus for emotion is gone, sympathetic nerve signals cease and the adrenalin in the blood is gradually diluted; hence blood pressure, heart rate, and other signs of autonomic activity gradually return

to normal. A young healthy person recovers from startle in a minute or so, from strong emotion in 15 or 20 minutes. When young children's outbursts of anger were observed, 24 percent lasted only a minute, 71 percent were over in 4 minutes or less, and 87 percent were over in 15 minutes or less.⁵

PRACTICE PROBLEMS

Suppose you ask a friend to be a subject for a little experiment. You make a loud noise by banging a book on a table and watch his eyes to see if he blinks. If this experiment S is 1 _____ and R is 2 _____.

3. Now suppose you do this several times and after the fourth time he no longer blinks. What has happened? (a) Fatigue; (b) maturation; (c) inhibition; (d) activation.
4. How can the reflex be restored?
 - a. Make a louder noise.
 - b. Have the subject turn his eyes away.
 - c. Tell him the experiment is harmless.
 - d. Wait a half-hour and repeat.

In an experiment on emotion which are dependent variables and which are independent variables? Mark each Dep or Ind.

- | | |
|--|--------------------------|
| 5. _____ Diameter of pupil of the eye. | 8. _____ Blood pressure. |
| 6. _____ Electric shock. | 9. _____ Brain waves. |
| 7. _____ Blushing. | 10. _____ Loud noise. |
11. Adrenalin has been considered an integrating agent like the nervous system. Why?
 - a. It is influenced by emotion.
 - b. It coordinates activities in different parts of the body.
 - c. It operates rapidly.
 - d. It is usually secreted when the regular brain rhythm is blocked.
 12. In respect to emotion which of these does not belong with the others: heart rate, blood pressure, digestion, muscle tension?
 13. Pleasantness is to attraction as unpleasantness is to _____.
 14. _____ "Redheads are more easily aroused to anger than other people." True or false?

Basic Drives

Much of the behavior of man and the other animals, when observed over a period of time, appears to be directed toward a goal of some sort. A man puts his hand in one pocket, then in another. Then his movements become more rapid, and he reaches in another pocket, pulls out a pack of cigarettes, lights one, and stops searching. A dog smells food, runs around, jumps, barks, sits up and begs. If you give him the food, he eats it and begs no more. Observing such a sequence of behavior, directed toward a goal, we say that the organism has a *drive* for that goal. Generally the sequence of behavior

can be divided into two kinds of activity: preparatory or *instrumental activity*, such as the searching and the running, and consummatory or *goal activity*, such as smoking and the eating. Naturally we do not observe the drive; we observe the sequence of activities oriented toward the goal, from which we infer the drive. Thus the drive is not a fact of observation but a construct, invented to explain a series of observations.

Reflexes typically are localized in one part of the body; emotions and drives involve the whole organism. Reflexes and emotions are relatively brief reactions to external stimuli, influenced somewhat by the internal condition of the organism; drives are persistent patterns of action integrated mainly by the internal condition of the organism, influenced somewhat by external stimuli. The chart below is intended to clarify these distinctions.

REFLEX	EMOTION	DRIVE
Localized	Organismic	Organismic
Reactive	Reactive	Active
A few seconds	A few minutes	Persistent
Small output of activity	Large outburst of activity	Flexible output of activity

These differences are not clear cut, and these terms are often used loosely. But hunger, thirst, and sex are typical drives that can be clearly described and differentiated from such typical emotions as fear, anger, and joy. They are often called biological or physiological drives because they originate in the body and have important biological consequences. They may be called primary drives in contrast to the secondary drives to be described in the next chapter. In the lower animals such drives are often called *instincts*, but the word "instinct" is restricted to drives that are inherited, so the question of instincts in man cannot be clearly answered at present. Human beings probably inherit some parts of these complex behavior patterns, but we shall see in the next chapter that the inherited parts are considerably modified by social learning.

Hunger. The behavior of a dog that has been without food for some time is easily observed. He is restless. He runs around, sniffs here and there, perhaps digs. Not only is his general activity increased, but his behavior is steered in certain directions rather than others. He is particularly responsive to certain smells. He will respond quickly to sights and sounds previously associated with food. Stimuli that might arouse his interest at other times, like the playful puppy next door or a comfortable bed in the sun, are now ignored. When he finds food, he eats, and his level of activity drops sharply. He licks his chops and lies down.

The chief difference between a drive like hunger and an emotion like fear is that under the influence of a drive the individual is prepared to make certain responses to certain stimuli, and thus his behavior has some

direction and some continuity. When an animal, including man, is hungry, he does not wait until he is startled by food; he goes looking for food. The instrumental activity includes sensitization of perception to promising sights, sounds, and smells, and a readiness of the muscles and glands for the consummatory activity. Stimulus variables in the environment have some influence in raising or lowering the drive, but the O variables are primary, so we make s small and O large. Representing instrumental activity by numbered responses and goal activity by R_g , we diagram the sequence of be-

havior thus: $\begin{matrix} S \\ \searrow \\ R_1 R_2 R_3 R_4 \dots R_g \\ \nearrow \\ O \end{matrix}$

The goal response may be considered a reflex or chain of reflexes prepared in advance and automatically released when the goal object is reached. The instrumental activity is more flexible. If the path to the goal is not clear, the instrumental activity takes on a trial-and-error or exploratory character. With practice a more direct path to the goal is learned—as we shall see in a later chapter.

We can use our knowledge of the hunger drive to control the behavior of animals—and even humans under some conditions. We can lure animals where we want them by locating the goal object there. A goal object, like food, used in this way is called a *reward* or *incentive*. Knowing the importance of O variables we schedule training periods before meals rather than after meals.

A rough sketch of the physiology of hunger would go something like this: The body uses up food, producing a change in the chemical contents of the blood, particularly a drop in the amount of sugar in the blood. The blood flowing through the stomach increases the contractions of the stomach muscles. The blood flowing through certain nerve centers in the brain stimulates these centers to organize a set for food stimuli and the appropriate goal response. When the hungry person gets food, this complex integration of the body is relaxed. When the food is used up, the cycle starts over again.

When a hungry person is asked to describe his conscious experience, he may say he feels “empty” or “hollow.” He may speak of a “hunger” or “wish” or “desire” for food and a “pressure” or “urge” to do something about it. The words in common use for labeling emotions and drives were chosen long ago to fit the conscious experience rather than the behavior or the physiology. Since the organism is set for food, food is at the center of consciousness. Attention is focused on food, and if a person is extremely hungry he may even have daydreams or fantasies of food. In addition he feels the increase in tension because of feedback from the muscles and thus is conscious of a force or drive pushing him toward the goal.

Thirst. This drive is similar to the hunger drive in many ways, though the cycle is shorter. It begins with a shortage of water in the blood. This pro-

duces feelings of dryness in the mouth and throat. Blood flowing through the brain influences a nerve center that integrates a set to perceive water and make the goal response. The conscious experience, of course, is called thirst.

Sex. The sex drive is more complicated than the other drives, partly because two organisms are involved. Preparatory activities are especially complicated. A male seal, for example, will stake out a location on the beach and fight other males to establish his territory several weeks before a female seal arrives. The Siamese fighting fish builds a little house out of bubbles on the surface of the water, then coaxes a passing female to enter it with him. Many reptiles and birds display elaborate courtship activities preparatory to mating, perception of which arouses complementary preparatory activities in the opposite sex and facilitates goal activity.

The preparatory activities of human beings take many forms, most of which involve bodily contact, especially oral contact. Consummatory activity likewise takes many forms. Unlike hunger and thirst, sex is only a drive, not strictly a bodily need. Variations in the goal responses of hunger and thirst are limited by the fact that animals that do not get food and water soon die. Since sex does not supply the individual with anything necessary for life, many variations in sexual activity, including complete abstinence, can occur without noticeable harm. And both preparatory and goal activities are modified by social customs.

Since two organisms are involved and the preparatory activities are so complicated, the sex drive is in some respects a social drive. The goal object is not a physical object, like food and water, but another organism. And the goal activity is a social interaction. During the 12 to 14 years required for maturation of the sex drive social relations are developing also. Hence the sex drive of human beings is closely associated with other social drives. It is hard to separate preparatory activities that are specifically sexual from the effects of the social motives to be discussed in the next chapter.

The bodily integration of sexual activities is organized by hormones secreted into the blood stream by the sex glands, periodically in the lower animals, more or less constantly in apes and man. These hormones act on the nervous system to sensitize perception to certain patterns of sight, smell, and touch, and to prepare the genitalia for the goal response. Then this integration is sharpened by preparatory stimulation. Under some conditions removal of the sex glands eliminates the sex drive. In such cases injection of sex hormones brings the drive back to normal. Men and women, in comparison with other animals, are influenced less by hormones and more by learning, both the learning of attitudes and the learning of skills.

Exploration and Curiosity. In simplest form the exploratory drive is the increase in activity that all healthy animals show in unfamiliar surroundings.

Among the higher animals a percentage of this activity is perceptual; they survey the situation. And a percentage is motor activity; they run around and manipulate anything movable.

Watch your dog when you take him into a strange place. He will run up and down, looking the situation over, sniffing at everything unusual. His activity level will remain high until he has explored the environment. Or if a new object is brought into his own yard, he will show the same investigative activity. This is not the hunger drive; in fact, it has priority over the hunger drive, for he will not eat until he has explored the situation. Rats will cross an electrified floor and take a shock in order to nose around among old papers and shavings on the other side (see p. 38).

Our friends and distant relatives the monkeys are famous for their curiosity. If one of the gadgets shown in Fig. 2.5 is put in a monkey's cage, the monkey will spend hours taking it apart.^{6, 7} He does not get food or water or any other extrinsic reward; like a small boy with an alarm clock, he takes it apart just for the fun of it. He works at it attentively and soon learns to take

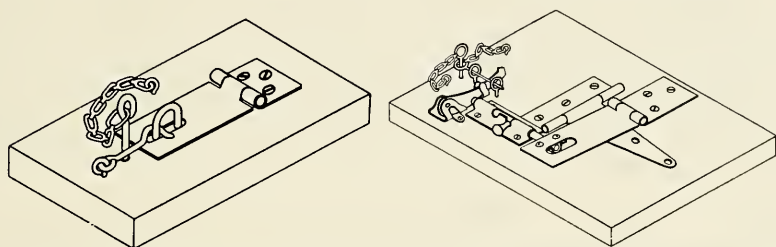


Fig. 2.5. Two puzzles that motivate monkeys. The one at the right requires six moves in correct sequence. (From Harlow, Harlow, & Meyer,⁶ and Harlow⁷)

it apart quickly. In respect to curiosity instrumental activity and goal activity are indistinguishable.

Human beings, with superior abilities, explore a new situation and register its general outlines rapidly and unconsciously. When you enter a room, you quickly take in the location of the floor, the ceiling, and the walls. You locate open spaces and barriers. You adjust to the illumination. If a new object comes into the room, you can perceive it quickly because you are already familiar with the lights and shadows and the background. If you are startled, you can move quickly because you are familiar with the open spaces and barriers around you. This exploratory survey of the environment takes place at once and has priority over other activities. When you go into a dark theater, you do not orient to the show until you have oriented to your seat.

When the situation permits, human beings are motivated by sheer curiosity, though it is hard to separate this drive from the others. Many people

work a crossword puzzle just for the fun of it and many read a detective story just for the intellectual challenge. And some students register for college courses and study them in order to explore new fields of knowledge. We shall see in Chapter 8 that curiosity, or something like it, has been the motivating force behind many of the creative accomplishments of civilization.

Homeostasis. When life began on this earth, it was a simple kind of life that could exist only where the environmental conditions were favorable. In the tropical oceans, for example, temperature was constant and the chemistry of the environment was uniform. But gradually mechanisms were evolved for maintaining constant internal conditions in spite of changes in the environment. Thus life could venture into fresh water and onto land. In time living animals were able to carry on their bodily processes on deserts, mountains, and glaciers.

The body of a complex animal like man resembles a complex kitchen, cooking up an assortment of chemical dishes and serving them through the blood to all parts of the body. These chemical reactions can take place only when the kitchen is in proper condition. The internal temperature must be maintained at about 100° F. Oxygen supply must be adequate. Carbon dioxide and other waste products must be removed. Fortunately, there are several built-in mechanisms that perform these housekeeping functions automatically. *Homeostasis* is a general term for the maintenance of internal bodily conditions in a constant state that is favorable for life.

What has all this to do with psychology—that is, with behavior? Some of the homeostatic mechanisms operate internally with no direct influence on external behavior, but others influence both behavior and conscious feelings. When the temperature of the body falls, for example, we feel cold. We may shiver, get restless, and move to a warmer place. When the temperature rises, activity level and alertness fall. We feel warm and perhaps move to a cool place. These activities are controlled by a nerve center in the brain that is responsive to changes in the temperature of the blood. Similarly another nerve center raises or lowers the rate of breathing in response to a lack or a surplus of oxygen in the blood. Anyone who doubts the motivating power of the breathing mechanism can perform an instructive experiment by holding his head under water for a half-minute. The interference with breathing quickly causes a tremendous increase in activity level and a vivid sensation of suffocation. Usually these homeostatic mechanisms correct the unfavorable condition automatically and quietly, but when the condition persists and the response is inhibited, they act like drives.

Hunger and thirst might be listed among the mechanisms that maintain the body in a favorable condition. Water is a necessity for most internal chemical reactions. Small amounts of many other substances are necessary

for maintenance of life: calcium, sodium, phosphorus, thiamin, riboflavin, etc. Ordinarily most people and most animals eating a variety of foods get sufficient amounts of these needed substances. If a shortage of salt or calcium or thiamin occurs, however, a *specific hunger* for these substances may be activated. Even a young infant will often choose foods that make up for a shortage in his diet.

Though the influence of specific hungers has been proved, we must not jump to the conclusion that the body has drives for all the specific foods it needs. We know that some bodily needs are not drives because rats deprived of vitamins A and D do not show any special preferences for foods containing these substances.⁸ And, in reverse, there are many attractive tastes, such as saccharin, and attractive smells, such as perfumes, that have no known connection with bodily needs.

Termination of Drives. If the drive starts a sequence of action, what stops it? Apparently the goal response triggers a special shutoff mechanism. The thirst drive is reduced when fluid is injected into the veins, as one might expect, but it also is reduced temporarily when the mouth is moistened—as if the goal response had been executed. The hunger drive is reduced when nourishment is injected into the blood, but it also stops when food enters the stomach, long before the blood receives any nourishment. The goal activity of the sex drive likewise activates a shutoff mechanism, quieting the drive temporarily.

PRACTICE PROBLEMS

15. Compared with emotional activity, instrumental activity is more (a) flexible; (b) vigorous; (c) reflexive; (d) stable.
16. Compared with instrumental activity, emotional activity is more (a) goal-directed; (b) persistent; (c) integrated; (d) intense.
17. Which term does not belong with the others: drive, goal, incentive, reward?
18. Drive is to instinct as development is to (a) motivation; (b) homeostasis; (c) emotion; (d) maturation.
19. Some psychologists working with infrahuman animals speak of a food-getting drive rather than hunger. Why?
 - a. The cycle is shorter in the other animals.
 - b. The drive is stronger in the other animals.
 - c. Hunger refers to consciousness.
 - d. Hunger is an instinct in the infrahuman animals.
20. Wish is to incentive as thirst is to (a) water; (b) reward; (c) consciousness; (d) blood sugar.
21. Which term does not belong with the others: eating, drinking, courting, mating?
22. Emotion is to excitement as homeostasis is to (a) relaxation; (b) balance; (c) goal; (d) chemistry.
23. In respect to the sex drive which part is most restricted by social customs?
 - (a) Preparatory activity; (b) goal activity; (c) physiological changes; (d) consciousness.

In an experiment on the hunger drive which are dependent variables and which are independent variables? Mark each Dep or Ind.

24. _____ Time spent on goal activity
25. _____ Feeding schedule
26. _____ Weight of incentive
27. _____ Speed of instrumental activity
28. If you were to telephone 100 people and ask them what they were doing, the largest number of replies would be classified as (a) reflex activity; (b) emotional activity; (c) instrumental activity; (d) goal activity.
29. Castration would have the most effect on sexual activity of which of these animals? (a) Man; (b) monkey; (c) dog; (d) rat.
30. Which of these needs has the shortest cycle in man? (a) Air; (b) water; (c) food; (d) sleep.
31. Which of these needs has the longest cycle in man? (a) Air; (b) water; (c) food; (d) sleep.
32. Why do we call a deficiency of thiamin a specific hunger?
 - a. Thiamin is necessary for reproduction.
 - b. Rats short of thiamin will work to get some.
 - c. Thiamin is part of a well-balanced diet.
 - d. Rats on diets without thiamin lose weight.

Biological and Social Significance

We have these reflexes, emotions, and drives, whether we like them or not. But now it is time to ask about utility. What do these motivational patterns contribute to the life of the organism? What do they mean to human beings living in a complex social environment?

Reflexes. Most reflexes have a protective value. When a ball comes at your head, you dodge. When something gets stuck in your throat, you cough and loosen it. When a pin sticks the baby, the baby cries, and may get relief. It is good that these reflexes do not have to be learned because they have a value, possibly a lifesaving value, right from the start. It is good that these reflexes can operate automatically, without thoughtful deliberation, because we are usually attending to other things when dangerous stimuli come along. However, a few reflexes, such as tickle, seem to be evolutionary accidents, of no known value to the organism.

Emotions. The life of most animals, man included, is a routine affair, punctuated now and then by emergencies. Throughout the years of evolution, therefore, the animals most likely to succeed were those that operated normally at a low level of activity, with the ability at any time to push activity up to the level required by the situation. The physiological aspects of emotion make sense when the whole pattern is regarded as an emergency mechanism that alerts the organism to vital stimuli and prepares the body for a higher level of activity. Supplying quick food to the muscles, improving cir-

culatation and respiration, increasing muscular tension—all these changes prepare the body for fight, for escape, or for pursuit. The action of adrenalin in aiding coagulation of the blood also has a grim emergency function. Digestion of food is routine business; it can wait until the emergency is past.

The control of this activation mechanism is very rough. It is not like the accelerator on an automobile that can be pushed precisely to give you just the speed you want, but more like a fire-alarm system that sometimes brings

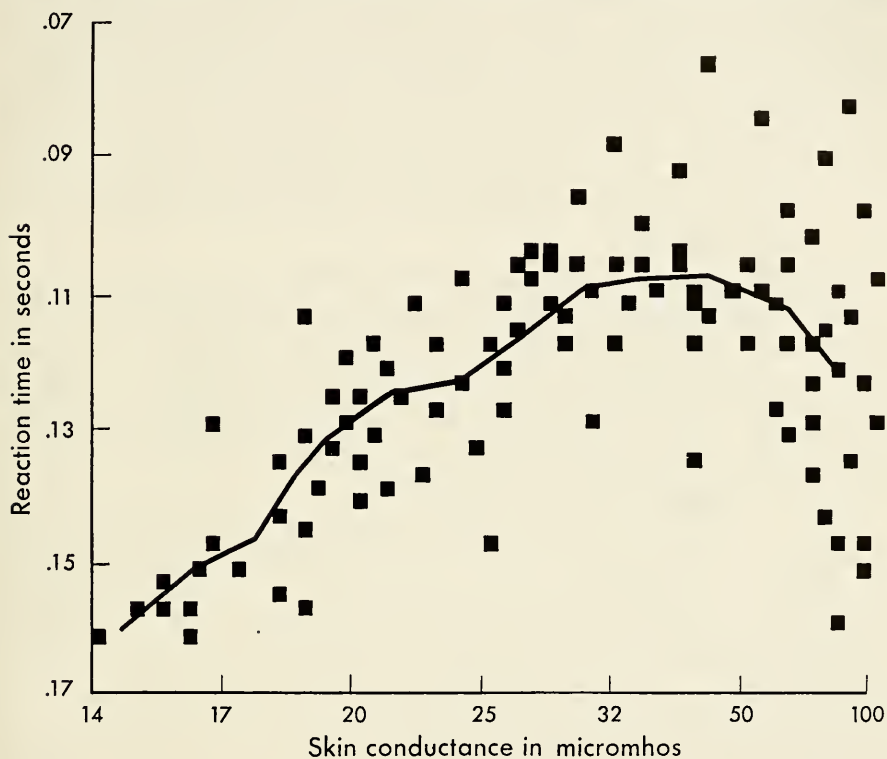


Fig. 2.6. GSR and readiness to react. A hundred measurements of palmar skin resistance and reaction time were taken simultaneously on one subject at various times of the day with the subject in various states of activation, such as rising from bed and just after an emotional crisis. This graph, like many other graphs of human performance, shows an optimal condition, above which and below which performance falls off. (From Freeman¹⁰)

out a fleet of trucks for a small bonfire. The emotion may overwhelm the organism, producing temporary paralysis, fainting, even a heart attack. The inhibitory effect on digestive activity of the stomach and small intestine can cause trouble. If the emotion passes quickly, the digestive disturbance usually passes quickly. But prolonged activation may keep digestive functions constantly on edge, and many physicians believe this is a contributing factor in the origin of ulcers.

There is probably an optimal level of activation for any human performance, depending on what the performance requires. When a rapid reaction to a stimulus is required, we know that alerting the subject by a warning signal, giving him a quarter of a second to get set, lowers reaction time. When the warning signal reaches the brain, the regular resting rhythm of the cortex is blocked and the brain is prepared to receive the new stimulus. Electroencephalographic experiments have demonstrated that if the stimulus is given before the resting rhythm ceases, that is, before the cortex is alerted, reaction time is longer.⁹ But the individual can also be too intensely aroused. Fig. 2.6 shows that when reaction time is measured at several degrees of activation, as indicated by the conductance of the skin, an optimal level appears, beyond which performance falls off.¹⁰ In the case of anxious individuals, unable to relax, the new tranquilizing drugs seem to depress the lower brain centers that activate the organism, so that they are not so continuously alerted to environmental stimuli.

In general, when the task requires fine coordination of hand and eye, originality, or good judgment, the best condition is a mild degree of activation, such as we call alertness or vigilance. On such tasks strong emotion can produce muscular unsteadiness, loss of flexibility, and a tendency to jump to conclusions. When the task requires muscular strength, endurance, or resistance to pain, and errors can be ignored, the optimal condition is the high level of arousal produced by strong emotion.

Drives. It is easy to see the biological usefulness of the basic drives and homeostasis. Getting food and water and maintaining favorable chemical conditions inside the body are very complex activities. If they were left to chance or to individual trial and error, the organism might be dead before the right responses occurred. Therefore these drives may be called physiological needs, and we may assume that they are the results of a long evolutionary process, like our hands and teeth.

But some drives are not needs. Many people have a strong drive for cigarettes, which do not supply the body with anything it needs. The social drives of the next chapter have no special connection with bodily needs. And even though the body needs certain chemicals, like phosphorus, there is no specific drive for these. We should not assume that what an individual wants is the same as what he needs.

The sex drive is different from hunger and thirst in that it does not supply any need of the individual. Its biological value is for the species, not the individual. If animals that reproduce sexually had not, during the course of evolution, developed some mechanism like the sex drive for attracting the sexes to each other, the species would not have reproduced itself and would not have survived.

A drive operates by narrowing attention to certain goal objects, or things

associated with goal objects. When college students tried to memorize a list of 27 words, 8 of which were food words like "bread" and "steak," the group that did the experiment just before dinner associated each food word with the next word in the list surprisingly well. Since this was not true of a control group that did the experiment after dinner, the conclusion was that the sight of the food words sensitized the hungry subjects so that they quickly differentiated these words from all the others.¹¹ This narrowing of attention is an advantage because we cannot attend to everything in the world; we have to be selective. It is a disadvantage when we center attention too intensely and overlook subtle stimuli (see p. 73). When other drives are quiescent, behavior may be motivated by curiosity, a broad sensitivity to unfamiliar stimuli and unexplored situations. This curiosity about the environment has a long-term utility as contrasted to the short-term utility of goal-directed attention.

Psychologists study the basic drives because principles of psychodynamics help to explain the activities of living organisms. Men and women are organisms with basic drives something like those of the other mammals. But we anticipate our needs and store up food and water in advance. We make clothes and build houses before cold weather arrives. We spend more time on instrumental than on goal activity. Furthermore, we are specialists; we divide up the work. The fact that people are animals with biological drives accounts for the existence of farms, families, restaurants, drinking fountains, delivery systems, furnaces, electric fans, oxygen tanks, and salt shakers. A large segment of modern business organization is given over to satisfying the biological needs of people. In the civilized way of life the forethought of human beings and the economic division of labor satisfy biological drives, with the exception of sex, quite regularly, leaving time and effort free for the operation of the more sophisticated drives to be described in the next chapter. Ordinarily in civilized conditions hunger and thirst are not strong drives, but during warfare, hard times, floods, and other catastrophes, when civilization breaks down, the basic drives may reassert their dominance.

Assessing Emotions and Drives

It is one thing to know the effects of motivation, and it is another thing to begin with these effects and work backward to diagnose the motivation. As a rule, the three aspects of these dynamic patterns, the behavior, the physiology, and the consciousness, go along together. When someone is extremely angry, for example, his behavior will show it, his blood pressure will show it, and he will tell you he is mad. If someone's activity is directed entirely toward food, his blood sugar will be low, and, if you ask him, he will say he

feels hungry. But some interesting exceptions to this rule occur in social situations where people try to control their behavior—in accordance with social motives to be described in Chapter 3. The complete pattern may not occur, because behavior and reports of consciousness can be inhibited.

When someone exhibits emotional behavior and physiological signs of emotion but is not conscious of the emotion, we can call it an *unconscious emotion*. *Unconscious drive* is defined in the same negative way. Someone avoids a threatening situation or shows preparatory activity toward a goal but does not report the feelings that usually accompany such behavior. A small boy, for example, always avoids the street where a big dog lives. He gets tense and his voice cracks if the dog comes near him. But he says he is



Fig. 2.7. Facial expression of emotion. A news photograph taken on a street in Marseilles, February, 1941, when the German army entered the city and French flags were hauled down. (Courtesy Press Association, Inc.)

not afraid of dogs. Either he is deceiving us or he is not conscious of the emotion. Naturally we cannot observe his consciousness; we have to depend on what he says, but we can seldom be sure that anyone's reports of his feelings are an accurate guide to his emotions.

One good index of emotion is emotional behavior. If someone runs and yells and fights, it is a safe guess that he is excited. Avoidance is a sign of fear. Approach is a sign of attraction to a goal. Part of this emotional behavior appears in the face and voice for anyone to observe (see Fig. 2.7). The presence or absence of emotion can be judged fairly well by the muscular tension that shows in the face and voice during conversation. But when people are asked to name the emotions expressed in still photographs posed by expert actors, the agreement between judges is low, partly because the names of emotions are not standard. The judges agree quite well, however,

if they are asked to sort the emotional photographs in these six broad categories: determination or anger; disgust; contempt; love, mirth, or happiness; surprise; suffering or fear.¹² Good agreement is obtained also if the photographs are rated 1 to 9 in respect to three dimensions: pleasantness-unpleasantness; attention-rejection; sleep-tension.¹³ Judgment of the genuine emotions that we see in daily life is somewhat easier because we see a sequence of movements rather than a snapshot; on the other hand, people often inhibit their emotions or at least do not express them as trained actors do.

Are these emotional expressions inherited or learned? A few, like tension, laughing, smiling, and crying, are inherited. They appear all over the world, and they appear in blind children who have not been able to imitate others.¹⁴ Apart from these few facial reflexes and the increase in the pitch of the voice as tension increases, emotional expressions are a learned social language. Children begin with the crude inherited patterns and acquire more complicated patterns to communicate more subtle feelings. As they grow older they express themselves more accurately and they read others' faces more accurately.

A direct method for measuring drives in lower animals

is to put a barrier between them and the goal object or incentive. The obstruction method measures how much an animal will do to get the goal object.¹⁵ The obstruction box, shown in Fig. 2.8, consists of three chambers, with the animal in one, the food or other goal object in another, and an electrified grid in the middle as a barrier. In order to get the food the animal has to cross the grid and take a shock. As soon as he gets a nibble, he is removed to the starting chamber, and he crosses again. The number of times he takes a shock in order to cross to the incentive is the measure of the strength of the drive. With this apparatus not only hunger and thirst can be measured but also the sex, maternal, and exploratory drives. A male can be put on one side and a female on the other. Or a mother rat can be put on one side of the grid and her litter on the other. When we measure the hunger drive, we must give the animal plenty of water. When we measure the

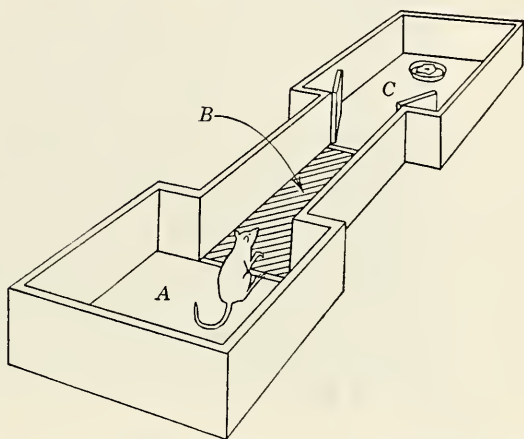


Fig. 2.8. Columbia obstruction box for measuring animal drives. The animal is placed in the entrance compartment, A, and has to cross the electrified floor in B and take a shock to get to the incentive in C. (Reprinted with permission from H. F. Harlow, *Studying animal behavior*, in T. G. Andrews, Ed., *Methods of psychology*, 1948, John Wiley & Sons, Inc.)

drive for water, we must be sure the animal is not hungry. The relative strengths of several drives in the white rat, when each is at its maximum and the others are not active, are shown in Table 2.2.

TABLE 2.2. Relative Strengths of Drives in the White Rat

Drive in Operation (others quiescent)	Average Number of Crossings
Maternal	22.4
Thirst	20.4
Hunger	18.2
Sex	13.8
Exploratory	6.0

SOURCE: Warden.¹⁵

When we try to use the obstruction method for assessing the basic drives of human beings, we run into difficulties. We cannot put people into boxes. The obstruction principle is still useful, however. If we can observe how hard a person works to get something, or what obstacles he overcomes, we can estimate the strength of his drive for that object. If we can get records of money spent on various activities, this is useful information about drives also. Girls spend more on clothes than boys in the same income bracket, and boys spend more on automobiles.

We know also that emotions and drives influence attention. To use this principle in reverse as a test of drive, we observe what a person looks at, what he listens to, and what he talks about. One may inhibit overt activity and may even deny that he is hungry, but if he looks for food and talks about food, we can infer a drive for food. If a girl talks about boys all the time and sees and hears boys before others do, a strong drive must be directing her activities toward them.

When observations of behavior are not convenient, we can assess the dynamics of behavior by asking people about their feelings and activities. Are you tense most of the time? How frequently do you have sexual dreams? Do you enjoy puzzles? Most of our evidence about the sexual behavior of human beings has been collected by direct questions in personal interviews; under ideal conditions, when the subject is able and willing to answer accurately, this method is useful. If there is some reason for denying or exaggerating some answers, the results may be distorted. A later chapter will consider the good and bad points of printed inventories based on this method.

Physiological tests of emotion usually require cumbersome apparatus for each test and are used chiefly for research. But several physiological instruments can be built into one machine so as to give several records simultaneously on moving paper. Any such instrument that makes more than one

graph is called a *polygraph*. When used to detect emotion connected with guilt, it is called a lie detector. One portable commercial model which records pulse, blood pressure, breathing, and GSR appears in Fig. 2.9 and a short strip of record in Fig. 2.10.



Fig. 2.9. A desk model polygraph for recording respiration, galvanic skin response, heart rate, and blood pressure. (Courtesy Associated Research, Inc., Chicago)

In the detection of guilt the recording of emotion is not the difficult part. The trick is to arrange a situation so that the guilty person will become emotional while the innocent suspects will not. If, for example, the criminal dropped his gun or his fraternity pin at the scene of the crime, the sight of

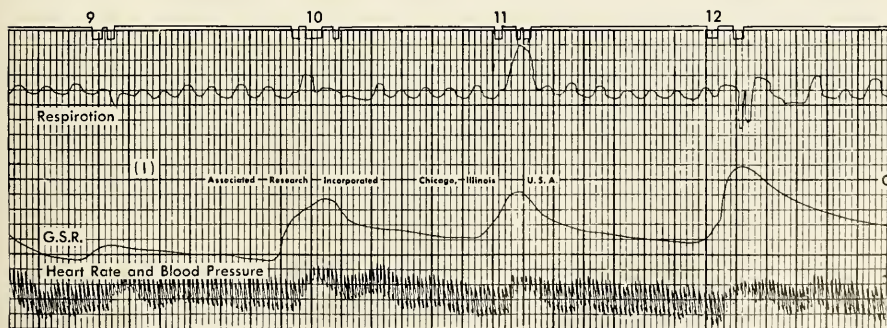


Fig. 2.10. Sample polygram from instrument shown in Fig. 2.9. Reading from left to right, the emotional stimuli are indicated by numbers at the top of the record, and the changes in respiration, GSR, and blood pressure follow. The vertical lines on the paper are time lines, one second apart, with heavier lines to mark five seconds. (From Associated Research, Inc., Chicago)

these in the district attorney's office will have an emotional effect on him but not on the innocent suspects. Often questions can be asked that will excite the guilty but not the others. There is nothing mysterious about the principle on which lie detectors operate, but some training and ingenuity are required for accurate results in practice. In general, emotional behavior can often be controlled in self-defense, and reports of conscious feelings can be slanted, but it is much harder to fake the physiological activities.

Individual Differences

Knowing the basic action patterns, where they come from and how they operate, one would next like to know how people differ, one from another, in these activities.

Heredity may be a factor in excitability. Some people have nervous systems with a low critical point; they explode easily. Such excitability is largely under the control of the glands and may be modified by endocrine treatment. Since some psychoneurotics do not recover from an emotional upset as quickly as other people do, part of the trouble may lie in the sympathetic system or the adrenal glands. Emotional excitability may result also from certain illnesses of childhood.

Individual differences in emotionality are due also to differences in learning, either of specific emotional responses to specific stimuli, or of general attitudes toward expression of emotions. Some children are exposed to the ideal of self-control, a calm refusal to get upset. Others are exposed to the ideal of self-expression, a lively responsiveness to this exciting world. Girls are expected to inhibit violent emotions more than boys; the ideal girl is not as excitable or as aggressive as the ideal boy. When boys and girls of high school and college age are asked about their emotions, more girls than boys report shyness, worries, and fears. More boys than girls, however, get into behavior difficulties of an emotional nature, such as fighting.

There are large individual differences in the strengths of the drives, but we have little evidence on the origin of these differences. In interviews men report all types of sexual activity more than women.^{16, 17} There is considerable variation among men of different classes of income and education. Masturbation is more common among educated men. Sexual relations with prostitutes, homosexuality, and other socially taboo activities are more common among men with little education.

Age is the biggest single factor in individual differences. Some baby reflexes function for the first few months of life, then disappear. Newborn babies sleep about twice as much as their older brothers and sisters and three times as much as their grandparents. But once these babies get on their feet and start walking, they begin to operate at a more energetic level than their

elders. Children are more active than adults, but the activity is not well directed. They get less done.

As to emotions, the effect of age is to reduce the number of emotional outbursts, but these few last longer. Children are easily stimulated to anger, fear, and joy; and they recover quickly. Children go in for everything more wholeheartedly than adults. When a girl of eight is sad, she is 100 percent sad; when she is happy, she is 100 percent happy. Adults like to measure their emotions judiciously, giving each stimulus its proper response and no more.

One reason for these age differences in emotionality is the loss of flexibility of the circulatory system with age, which is shown by a slower rate of recovery from excitement. Furthermore most adults have learned to inhibit their emotions. Another reason is the adult's broader background of experience. An event that is new to the child may be perceived by an adult against a background of 50 such events. So the relatively flat emotional life of adults, as compared with the sharp ups and downs of boys and girls, is due partly to physiological effects of age and partly to wider experience and judgment.

The nature of the emotions changes with age also.

Some emotions weaken and others grow stronger, as shown in Fig. 2.11.

Age has a strong influence on the basic drives. The amount of food eaten in a day increases greatly during the first 20 years of life and falls off slowly after 40. Along with changes in amount go changes in taste, for adults like fats and sweets less, and highly flavored foods more, than children. The child's hunger cycle takes time to mature also. Infants do not fit into their parents' three-a-day routine; many have a special yen for the 2:00 A.M. feeding.

Sexual activity is also greatly influenced by age. Although some phases of sexual activity are present in infancy, the adult pattern usually appears between 10 and 25. There are large variations at all ages, however. Some high school freshmen are physiologically mature, while some college seniors are not. Amount of sexual activity of all kinds reaches a peak around 20, like

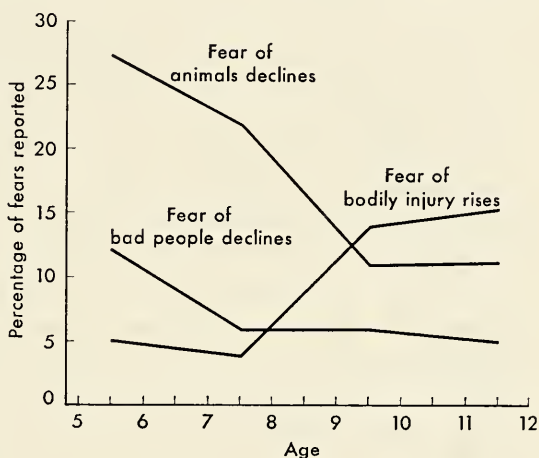


Fig. 2.11. Some of the fears mentioned by children at different ages. (Data from A. T. Jersild, F. V. Markey, and C. L. Jersild, *Children's fears*, Teachers Coll., Columbia Univer., 1933)

many other capacities, and gradually decreases. Those who are sexually active at an early age tend to marry early and continue to be more active than the average.

SUMMARY

For purposes of description and investigation behavior can be classified into reflexes, emotions, and drives. A reflex is a localized response to a stimulus. An emotion is an organismic response, characterized by activation of many bodily mechanisms and rapid recovery. The basic drives are more persistent, including instrumental as well as goal activity.

Reflexes are mostly of a protective nature. Emotions have an emergency function, alerting the organism for important stimuli and arousing the body to a higher level of activity. Most drives contribute to the life of the individual or the species, but the instrumental activities of the individual have been largely replaced by specialized agencies of civilization.

Under ideal conditions the evidence of behavior, physiology, and consciousness permits estimates of emotions and drives. But behavior, including statements of consciousness, can be inhibited; hence physiological measures are sometimes needed. Emotions are commonly judged from moving facial expressions, but judgments can also be made from still photographs with fair accuracy. Drives are assessed from records of behavior, especially of the overcoming of obstacles, from observations of the direction of attention and other preparatory activity, and from answers to direct questions.

People differ from one another in all these behavior dynamics, presumably because of heredity, medical history, and early training. Sex differences are small in general, while age differences are large.

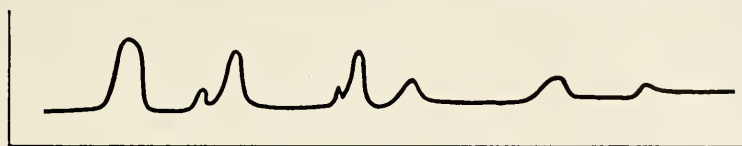
PRACTICE PROBLEMS

33. In one study of the development of emotions in children those children who showed the largest GSR also showed the most overt activity. Then the study was repeated with adolescents.¹⁸ From what you have read in this chapter, would you expect these two signs of emotionality to be more closely related in adolescents than in children? or less?
34. Some people drink a cup of coffee in anticipation of a stressful situation. This can substitute for the increase in heart rate during an emergency. Others spit on their hands. This can substitute for the emergency function of (a) sweat gland activity; (b) homeostasis; (c) digestive activity; (d) startle.
35. Which word does not belong with the others: need, drive, goal, motive?

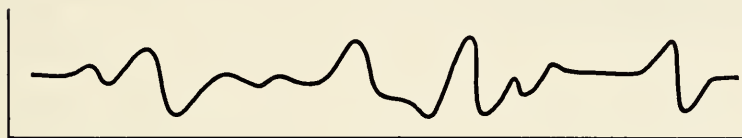
The following statements refer to Table 2.1. Those statements that are valid conclusions from the table should be marked Val, the others Inv.

36. _____ Everyone shows some physiological signs of emotions before jumping.
37. _____ Most reports of physiological reactions are too vague to be interpreted.
38. _____ Many trainees had passed the optimal level of activation.

39. ____ Many emotional reactions include homeostatic instability.
40. Which symptom in Table 2.1 refers to an inhibitory effect of emotion?
41. Which term does not belong with the others: activation, emotion, arousal, reflex?
42. If we had a record of blood pressure for an ordinary individual during an ordinary eight-hour day, would it look more like Fig. 2.12 A or B?



A



B

Fig. 2.12. Continuous blood pressure records.

43. The devices shown in Fig. 2.5, which monkeys take apart without extrinsic reward, have also been given to monkeys with food under the hasp. Would you expect this to improve performance?
44. Most drives narrow attention. Which drive does this the least?
45. The best way to differentiate one drive from another is by observing (a) level of activity; (b) instrumental activity; (c) goal activity; (d) duration of activity.
46. Lie detectors rely on physiological reactions because (a) they are the essence of emotion; (b) they are approximately the same in all normal people; (c) they measure the amount of adrenalin in the blood; (d) they are not easily inhibited.

Discussion Questions

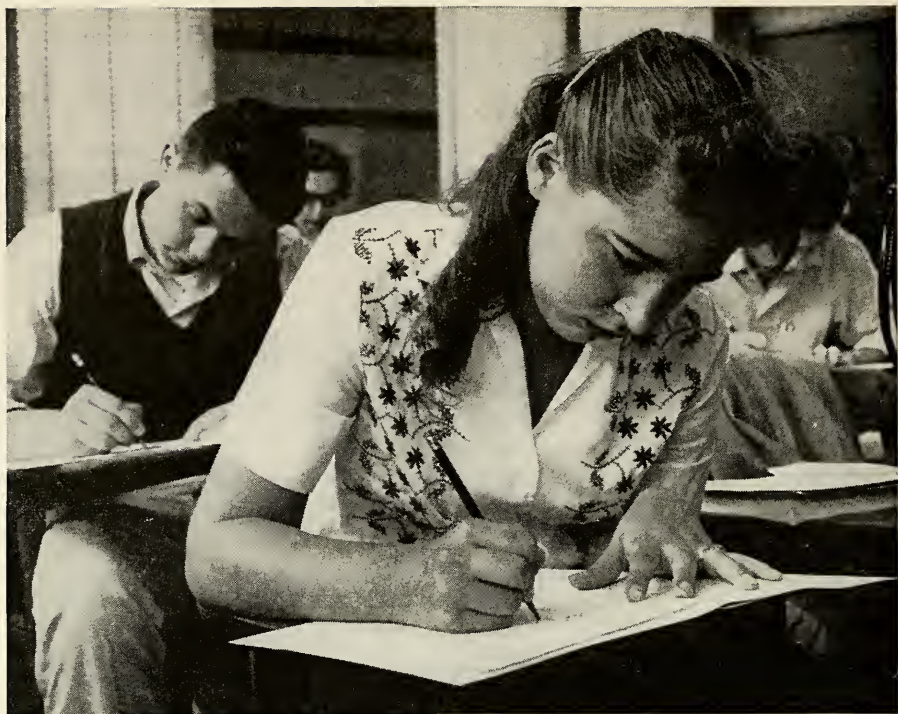
- A. Do machines have reflexes?
- B. If you were redesigning human beings for the 21st century, would you include an emotional mechanism?
- C. How do the emotions of a domestic animal, such as a dog, differ from the emotions of man?
- D. Are women more curious than men?
- E. If our culture restricted eating as it now restricts sex, what difference would it make?
- F. Should polygraph records be admitted in court as evidence?

Recommended Reading

- C. Darwin. *The expression of the emotions in man and animals*. D. Appleton, 1897. A classic account by the distinguished naturalist, with anatomical descrip-

tions and hypotheses about biological significance. Interesting old drawings and photographs.

- C. T. Morgan & E. Stellar. *Physiological psychology*. (2nd ed.) McGraw-Hill, 1950. A standard textbook. Chapters 16 to 20 deal systematically with physiological information about emotion, sleep and activity, bodily needs, instinctive behavior, and mating behavior.
- I. L. Janis. *Psychological stress. Psychoanalytical and behavioral studies of surgical patients*. Wiley, 1958. Report of a survey of patients' emotions before and after major surgery, including a detailed psychoanalytical case study of one woman.
- A. C. Kinsey, W. B. Pomeroy, & C. E. Martin. *Sexual behavior in the human male*. Saunders, 1948. A large-scale investigation by the interview method, with comparisons between groups classified as to age, education, and religion.
- A. C. Kinsey, W. B. Pomeroy, C. E. Martin, & P. H. Gebhard. *Sexual behavior in the human female*. Saunders, 1953. A companion volume to the above.
- C. S. Ford & F. A. Beach. *Patterns of sexual behavior*. Harper, 1951. A careful analysis and comparison of the sexual patterns of 190 societies and a considerable number of animal species.



Information Services, Michigan State University

Chapter 3. MOTIVATION:

ELABORATION AND CONTROL

All animals are capable of learning, and man is the best learner of all. When motivated, man learns new instrumental activities and attains his goals by new routes. More than that, he acquires new motives toward new goals and new aversions, some of which are highly abstract and civilized. In this chapter we shall see how these diverse motives and goals are acquired and how the individual integrates them as he prepares to act.

Social Motives

When we try to account for the dynamics of human activity, the basic drives of the preceding chapter do not carry us very far. The concepts of activation and direction of behavior are still useful, but the activities of civilized men and women seem to be directed only occasionally toward physical goals, like food, and much more often toward some kind of social interaction or status. The goal activity is frequently activity which evokes rewarding responses or social feedback from other people. And it is these social incentives that are manipulated by advertisers, politicians, teachers, and others who attempt to influence human behavior.

Psychologists use the terms "motive" and "drive" almost interchangeably, but "motive" is the more general term for anything in the organism that directs activity toward a goal, while "drive" is a more specific term for an internal chemical condition, such as a hormone or a deficiency of sugar, that directs activity toward a goal. Thus we hear much of biological drives and of social motives.

The origin of the social motives is found, not in biological adaptation to the physical environment, but in the individual's adjustment to a social environment, motivated by the basic drives. Therefore they are often called secondary or acquired drives—or motives. These social motives depend on three

biological facts: (1) Human beings have a long infancy during which they are dependent on others. (2) They have a great capacity to learn. (3) They have the capacity of speech.

Since the social motives are influenced by so many different factors, individual differences are large. In fact, Chapter 12 makes use of these motives to describe personality and calls them dynamic personality traits.

We will describe three of the most important social motives, showing how they develop and how they influence behavior.

Social Interaction. One of the basic facts of human life is that people live and interact with other people. All people, all over the world, exhibit this tendency to "socialize," to be with other people. Even the hermits have the angels and their memories to keep them company. To explain this behavior

we assume a motive for *social interaction*, also called need for affiliation, sociability, and gregariousness. Social interaction is the central feature of the pattern. The individual responds to other people and he is rewarded when other people respond to him.

To understand the origin of sociability consider the newborn baby lying in his crib looking at the ceiling. He does not know people from things; he responds the same way to both. But moving objects attract attention, so when someone bends over the crib, the baby will take notice.

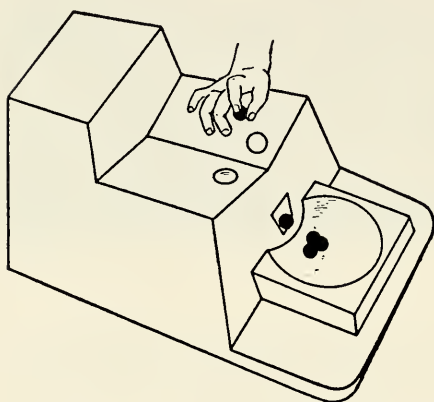


Fig. 3.1. Game used in experiment on social reinforcement.

Furthermore the movements that people make often have rewarding consequences for the baby. When the baby is hungry, someone feeds him. When he is uncomfortable, someone makes him comfortable. In fact nearly all the pleasant things that happen to him happen just after he feels or sees someone. Since the human infant is dependent on others for a long time, he becomes sensitized to the appearance of the human face, and when he makes a movement or a sound that is followed by this appearance, he is likely to make that response again. In general, the motive for social interaction is learned while growing up in a family and having one's wants satisfied by people.

When the baby grows up and out of the crib, he will get other kinds of rewards from people. When he learns to talk, he will observe that his verbal responses evoke verbal responses from other people. He will then be motivated to get attention, communication, and more elaborate kinds of interaction

with other people. By age seven or eight this motive is so well learned that it can be experimentally manipulated in the laboratory and used to control behavior. In one experiment children of this age were allowed to put marbles in one of the two holes of the apparatus shown in Fig. 3.1 and watch them come out at the bottom.¹ Most children use one hole more than half the time, so the experiment was designed to show how social rewards from the experimenter would reinforce the learning of a preference for the other hole. After the child had played for four minutes, the experimenter noted which hole he had used more often, then rewarded him each time he put a marble in the other hole—simply by saying “Good” or “Fine.” Under ordinary conditions the proportion of shifts to the other hole was 22 percent. But when

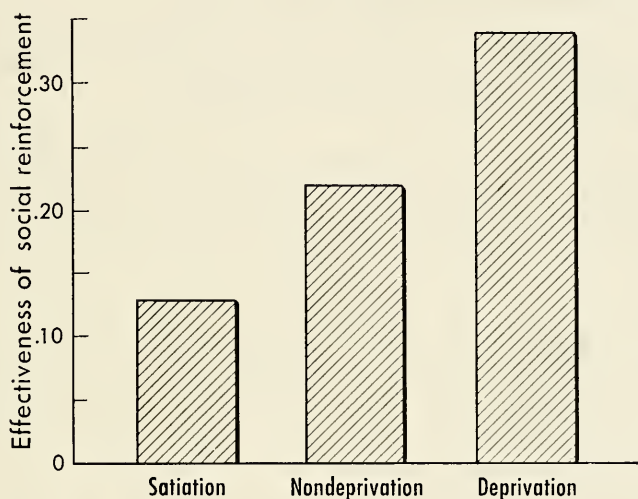


Fig. 3.2. Effectiveness of social reinforcement on game shown in Fig. 3.1 after three conditions of social interaction. (Data from Gewirtz & Baer¹)

the game was played by children who had been deprived of social interaction in an isolation room for 20 minutes previously, the effectiveness of the social rewards was 34 percent. Another group of children played the game after they had been in close social interaction with an adult like the experimenter, and the effectiveness of the social rewards for these satiated children was only 13 percent (see Fig. 3.2). Hence we can conclude that the strength of this social motive is influenced by deprivation and satiation in much the same way as are the biological drives of the preceding chapter.

At a later age social interaction takes even more sophisticated forms. Boys and girls enjoy telephone conversations and letters. As life becomes more complicated, they are made unhappy by people also. The strength of this social motive goes up and down according to success and failure in social relations.

Thus when they reach the age of 20, people vary widely in sociability. Since sociability is an obvious aspect of behavior, it is relatively easy to separate the highly social people from those who prefer to spend their time alone. If 10 people are rated for sociability by 2 people who know them well, the ratings will agree closely.

Another way of getting at individual differences in this motive is by a printed inventory of questions to answer or statements to be checked True or False.

I never go to the movies alone.

A man's best friend is his dog.

People bore me.

Between classes I always find someone to chat with.

The scores that different people make on these inventories are roughly consistent with their behavior in social situations.*

Individual differences in sociability are in part the result of successes and failures in social relations in childhood. Changes occur during adolescence, however. A girl who was friendly at age 10 may become shy at 16 if she is made uncomfortable in social situations for any reason. And the reverse occurs also. But after 25, people do not change their habits of social interaction so readily.

Social Approval. When the child begins to walk, his range of behavior increases, and he becomes capable of annoying people as well as pleasing them. To his parents he is no longer an inoffensive little bundle of charm. Sometimes he is a dirty little nuisance that breaks things. So his behavior evokes punishments as well as rewards from other people. Biological satisfactions and the joys of social interaction may be denied and physical pain may be inflicted. More often these punishments are only threatened. The child could withdraw from social interaction, and this has happened, but it is very rare. More often the drive for social interaction is so strong that he continues to interact with people, but now he does so selectively. He inhibits responses that bring punishment. As he grows in intelligence, he learns to classify some of his acts, on the basis of this social feedback, as "bad" and others as "good." Thus he inhibits responses that have been punished and responses of the same class that probably would be punished. Later he will learn the words "bad" and "good" and will actually label his own acts by these terms.

Much that older people do has no significance for the young child. But this good-bad aspect of their reactions to his behavior is very important to him. He observes faces, gestures, and voices for expressions of pleasantness and unpleasantness, because these have become signals that he may be re-

* See *Teacher's Manual* accompanying this text.

warded or punished. Thus he becomes sensitive to *social approval* and disapproval.

Later our growing boy or girl will read stories, see movies, hear sermons, and observe the lives of friends. His direct experience of social approval and disapproval will be complicated by secondhand learning. He may rebel against it all and deliberately seek social disapproval at times. At least he will frequently test the limits that adults will endure before punishing him.

Thus the motivation for social approval develops. It includes a sensitivity to the effects of one's behavior on others, a knowledge of the kind of behavior that is disapproved, and a readiness to inhibit such behavior. Different people approve of different acts and different styles of clothing, to be sure, but the growing boy or girl averages out these peculiarities and learns what is approved by most people most of the time. This generally approved pattern of behavior is called the *social norm*, and behavior that agrees with this norm is called *conformity*.

Social disapproval influences verbal behavior also. If the child pronounces his words as others do, in accordance with the social norm, he is likely to be rewarded. If he talks queerly, he may not get what he wants and, in addition, he is likely to be ridiculed by parents and playmates. He learns also that some words, such as "please" and "thank you," are good words that are followed by rewards. Some words are classified as bad words, followed by punishment or threat of punishment. He learns that some sentences and thoughts are bad also, such as "I hate you," so he inhibits these verbal responses.

How can we tell when someone is motivated by fear of social disapproval? There are several possibilities. Someone may do his work, not wholeheartedly, but with one eye watching others' reactions to his work. Spontaneous comments may reveal motivation: "I wouldn't want anyone to see me doing this," or "What are the other girls wearing tonight?" When people talk about their hopes and dreams, they may disclose fantasies of being humiliated in public. And people may be observed at the other extreme also, people who go about their business and make their own decisions regardless of what other people think. Most people, of course, are neither extreme conformists nor extreme nonconformists. But acts that conform to social custom are far more frequent than acts that deviate. This is what makes behavior predictable and allows society to run in its regular grooves.

Printed inventories to measure individual differences in sensitivity to social disapproval include items such as these.

I feel uncomfortable if I am different.

It is better to go ahead and do something than to waste time trying to do it right.

People who go their own way usually get into trouble.
I like to shock people.

A person growing up in an ordinary family, living through the ordinary social experiences, acquires an ordinary motive for social approval. Extreme sensitivity to social disapproval may develop if a person has been punished frequently or threatened by loss of social approval. Some families take social approval more seriously than others, and the children simply pick up this trait from their parents. People who are emotionally insecure, who have never been able to separate themselves from their parents and stand on their own feet, are often unusually sensitive to social approval. If someone is unsure of himself for any reason, he may not dare to risk any censure from others.

Extreme nonconformity may be due to adolescent rebellion, which is a kind of reaction against the authority of the parents. Teen-age rebels against social authority seem to flout the norms intentionally as if to show that they are not afraid of disapproval.

Highly motivated well-adjusted people often appear to ignore social approval. A low-power automobile has to stay on the smooth highway, but a high-power automobile can go anywhere. These highly motivated people are not deliberate nonconformists; they do what they want to do whether social approval is with them or against them.

Attitudes toward conformity may change in an intellectual way through education and experience. Many boys and girls learn in social science classes how the stability of society depends on social norms and mores. And some may learn that many of the heroes and heroines of history won their fame by defying social conventions. Their attitudes toward conformity will change also when they become parents and try to raise their children to be nice little boys and girls.

Achievement. Advancement toward any goal may be considered an *achievement*, as when a sleepy person reaches a place to lie down, but many goals are social goals and many achievements are defined in terms of advancement along some social scale. To many people the important scale is the occupational scale, and success is achieved by getting a job and working up toward the top. To others the important scale is one of fame or prestige, and achievement is measured by such symbols as medals, pictures in the paper, and invitations to dinner. Others are more concerned with intellectual achievements, like writing a novel or a new theory of market fluctuations. In college, achievement is measured on a scale of grades, D, C, B, and A. In general, the achievement motive implies a recognized scale of success, sensitivity to one's position on this scale, eagerness to move upward, and anxiety about falling downward. Other names for this motive are mastery, aspiration, prestige, initiative, persistence, and ambition.

There are several ways of estimating the strength of the achievement motive. Sometimes a person will announce his goal publicly or commit himself to a course of action leading toward a known goal. We can observe whether a person works hard to overcome obstacles, whether he organizes his daily life around advancement up some scale, or whether other motives such as social disapproval keep him down. Successful achievement alone is not a very accurate measure of the motive for achievement, however, because success depends on opportunity and ability as well as the achievement motive. Some people have to struggle to achieve success, some achieve success without half trying, while others have success thrust upon them.

Like other motives, the achievement motive influences perception and imagination. When people are fired up by ambition, trying to get ahead, they plan for the future, talk about their goals, and dream of success. This principle can be used in reverse as a test of achievement motivation. The subjects are shown some pictures and asked to write imaginative stories about them, about what the people in the pictures are doing and what they are thinking. Or they are given incomplete sentences and asked to finish them. References to success and failure in the stories, instrumental activities directed toward

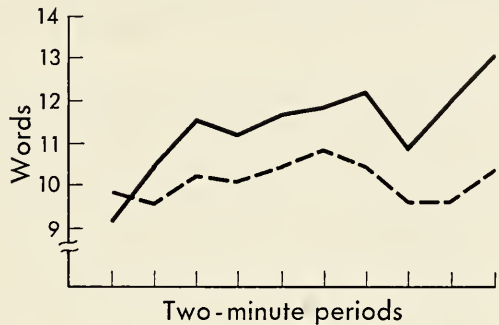


Fig. 3.3. Achievement motivation and output. The task was to make words out of scrambled groups of letters, e.g., WTSE. College students were divided, on the basis of imaginative stories they had written, into a group of high achievement motivation (upper curve) and a group of low achievement motivation (lower curve). (From Lowell²)

achievement, and emotions connected with these are taken as signs of the achievement motive. Scores obtained agree to some extent with persistence in overcoming obstacles,² as shown in Fig. 3.3. Scores obtained from a printed inventory of questions about achievement motivation also agree with performance on a laboratory task.³

It is often possible to arrange conditions in the laboratory or clinic so that a person has to choose among goals spaced along a scale of achievement. We can offer him a series of tasks of known difficulty, such as 10 puzzles graded from easy to hard, and see which one he tries. Or we can give him 10 shots at a target and ask him how many he hopes to make. This is called his *level of aspiration*. In either case we have to acquaint him with the scale of achievement before he can locate himself on it, and we do this by telling him how many people failed each puzzle or by letting him try 10 shots before stating his aspiration for the next 10. Usually aspiration is higher than

performance. If a person gets 4 out of 10 this time, he will aspire to 5 or 6 next time. When given an unfamiliar task to do, those who are highly motivated for achievement, as measured by the stories they have written, express aspirations far above their performance, while those of low achievement motivation express aspirations only slightly above their performance.⁴ But even the highly motivated bring their aspirations in line with their performance as they continue to work and get more realistic feedback about their performance.

This pattern of orienting upward begins early in life with the young child's experiences of success and failure. He bangs his cup on the table and makes a little noise. He does it again and it sounds louder. That is success. Later he puts one block on top of another and likes what he sees, so he adds another, and another. If all goes well, he gets fun out of overcoming obstacles, building things, and organizing his life so that he accomplishes something.

As the child grows older and works and plays with other boys and girls, his definition of achievement changes. Success is defined one way at school and another way at recess. Success at the Halloween dance is something else. Just as our hero learns what activities win social approval, he learns what activities win advancement on the scale of success. When he reaches college, he will be quite susceptible to the pressures for achievement put on him by the academic norms and particularly by the instructors. In one experiment, when college students were asked to write imaginative stories and told that this task was related to intelligence and leadership, the stories had many references to success and ways of achieving success and avoiding failure. When students were given the same assignment and told that the results were of no importance, much less evidence of achievement motivation appeared in the stories.⁵

As a general principle, one's level of aspiration goes up and down with his successes and failures, though typically aspiration is slightly higher than past performance. But if someone has failed often, his aspirations may go off in an unrealistic way, unrelated to his past achievement. Some build their ambitions on nothing more substantial than a wish, like the D student who plans to go to medical school. Some who have failed often are terribly afraid of failure and set their goals very low so they cannot possibly fail again.

One's aspiration level is influenced also by the group to which one compares himself. If a college student taking a vocabulary test hears that the average high school student gets 30 right, he will probably aim for 35 or 40. If he hears that graduate students get 30 right, he will probably be satisfied to get 25.

Individual differences in achievement motivation are large. The goddess of success is worshiped more devoutly in the Western world than in the

East. Peak achievement to many Buddhists, for example, is self-purification, which is approached by laborious practice in self-denial and inhibition of biological drives. Within a complex society like ours the pressure for achievement is stronger in the middle and upper social classes than in the lower classes, as we shall see in Chapter 10. On the average, the pressure for achievement is greater on boys than on girls. But the principal difference between the sexes is the definition of achievement.

In addition to these group differences there are differences between families that affect the achievement motive. College students with high achievement motivation, according to the storytelling test, report family training in independence more than students of low achievement motivation. In the homes of both types of students there may be plenty of love and affection, but in the homes of the "highs" the son is more apt to talk back without deep feelings of guilt and to go off on his own rather than to submit to standards imposed on him by his parents.⁵

Thus it turns out, in a complex society like ours, that achievement is defined in many different ways, that the rewards are often subtle and abstract, and that success is often measured in relation to others so there is never enough to go around. Hence a thoughtful person will occasionally stop everything for an hour to ponder what goals he really wants to achieve.

PRACTICE PROBLEMS

Mark each blank according to the motive for each act: SI for social interaction, SD for fear of social disapproval, Ach for achievement.

Erich worked in a filling station during the summer vacation. When he returned to college in the fall, he dropped his bags in his room and rushed to the snack bar to see if any of his old friends were around (1 ____). There was no one he knew. He saw one face that looked familiar, but he was not sure he knew the fellow, so he did not speak to him (2 ____). He saw Sandra Michels, who sat next to him in Econ. last year, and he thought of going over to her table, but the way the other girls talked about her he decided he didn't want to be seen with her the first day (3 ____).

"Well," he thought, "if nobody shows up, I'll go back and straighten out my books and things. Maybe if I get started right, I can get on the dean's list this year" (4 ____).

While he was daydreaming, his eyes were on the door watching everyone who came in (5 ____). He found a newspaper and pretended to be reading so he wouldn't look conspicuous (6 ____). Finally he got tired of waiting and started back to his room. As he passed the library, he said to himself: "I guess I'll drop in a minute and see how they have arranged things this year. Might save me a little time when I have to work up a term paper" (7 ____).

The following unfinished story was given to a class of college students and they were asked to finish it.

At Cislunar College one day in November Professor Motley opened his 10

o'clock history class with these words: "Since we have an examination scheduled for tomorrow, we will spend today in review. Mr. Algae, will you please tell us how . . ." At that moment a messenger opened the door and beckoned to Professor Motley. He stepped out into the hall and . . .

Two students, A and B, wrote these endings:

A. . . . was informed that his ailing mother had passed away, and would he rush home. He didn't bother to return to the classroom, instead he went to the airport and took the next flight home to his mother.

B. . . . returned shortly to announce that he would not be able to hold class the next day and that the review would have to be dispensed with and the exam held immediately.

8. Which of the two stories shows the stronger motivation for achievement, A's or B's?

C and D are more difficult.

C. . . . Algae grabbed a textbook and began to look up all the definitions he could before the professor came back. He only had time for one definition before the professor returned. Sweat rolled down Algae's face as he waited for the question he knew he couldn't answer. Professor Motley then continued his question. "Mr. Algae, will you please tell us how you think you'll like the test tomorrow?"

D. . . . when he came back into the room said, "Mr. Cratchit, you are wanted in the Dean's office. You may leave right away." After the commotion caused by Mr. Cratchit leaving had quieted, the professor said, "Now to continue, Mr. Algae. Will you please tell us how the Treaty of Paris was arrived at?"

9. Which shows the stronger motivation for achievement, C or D?

The following statements are used on printed tests of motivation for social interaction and fear of social disapproval. Mark each SI or SD to indicate the motive it is intended to test.

10. ____ The best way to get ahead is to observe what successful men and women in your own community have done.
11. ____ I get most of my good ideas from talking with other people.
12. ____ I would rather sell tickets for a play than paint the scenery for it.
13. ____ I would rather live my own life than be wealthy.
14. ____ I would rather read a joke than hear it told by an amateur.
15. ____ I usually study alone.
16. ____ The way to be happy is to stay out of trouble.
17. ____ I usually do what I please.
18. It is difficult to identify a maternal drive because it is easily confused with
(a) the sex drive; (b) economic motivation; (c) social approval; (d) the influence of hormones in the blood.

Inhibitions and Modifications

In our discussion of motivation we have come a long way, from primitive reflexes and emotions to biological drives and sophisticated social motives.

For purposes of definition it is well to remember the differences between typical examples of each but we should note also that the complex life man leads modifies these patterns and blurs the distinctions between them. As the child matures and anticipates the personal and social consequences of his behavior, some reflexes and emotions acquire drive properties, some biological drives are modified in the direction of the social norms, and expressions of emotions and motivation are edited. Acquiring motives is a cumulative process, like acquiring a vocabulary or a bank account.

Reflexes Become Drives. When your throat tickles, you usually cough once or twice, and this reflex dislodges the stimulus. But if you are in a broadcasting studio, you try to inhibit the response and go outside. Thus the reflex becomes a drive or, more precisely, the reflex plus fear of social disapproval motivates activity toward a prescribed goal. In babies urination and defecation are reflexes, but inhibition of these reflexes endows them with drive properties. They motivate activity persistently until the inhibition is removed. Any reflex can acquire drive properties in this way if the stimulus persists while the response is inhibited.

The usual sucking of infants seems to be just a localized reflex at first, but by association with feeding it is rewarded and becomes a drive in itself, more or less independent of feeding. Infants who get considerable practice in sucking, as in breast feeding, develop a strong sucking drive and are resistant to weaning.⁶ This does not happen so often to infants who are fed from a cup.⁷

Emotions Become Drives. Typically an emotional outburst is over in a few minutes, but not always. If someone is in a locked room with a time bomb that is about to explode, he will make persistent attempts to escape as long as he is able. If the threat is an abstract thing, like a slur on one's reputation, activity level or tension may remain elevated for some time, even at night when one tries to sleep. This persistent fear of something abstract or vague that cannot easily be avoided is called *anxiety*, and it is considered a drive because it increases activity and directs behavior, not toward a goal, but away from danger.

People show their anxiety by signs of muscular tension, such as biting the nails, pacing the floor, smoking, and scratching. Fine motor performances, such as writing and speaking, may be unsteady. When they talk freely or tell stories, they refer often to dangers and threats of punishment.

It is not always feasible to put people in threatening situations and observe signs of tension. An easier way to study anxiety is to ask people what they usually do or try to do or how they feel. The familiar questionnaire or inventory is used. Typical statements follow, to be marked True or False.

I often feel as if something terrible is about to happen.

When I am waiting for something, I usually take a short nap.

I worry about my health more than most people.
 I get along fairly well with my family.
 Whatever happens, things usually turn out best for me.
 I am a rather sensitive person.
 I have to watch what I eat.

People who get high scores on printed tests of anxiety like this are more sensitive than the average to threatening stimuli and in fact will learn protective reflexes, such as an eyeblink to a new stimulus, more readily.⁸

Frequently when the adjective "emotional" is used, as in such phrases as "emotional problems," "emotional adjustment," and "emotional conflict," it refers not to an outburst of excitement but to the drive properties of emotion, such as anxiety and anger. Hence in this usage "emotional" is synonymous with "motivational" and "psychodynamic."

Emotions Are Modified. As the child grows toward adulthood, his emotions are modified on the stimulus side and on the response side. Some of the change is due to maturation, but most of it is due to the social life he leads. He learns that his childish fears of barking dogs and strange people are groundless (see Fig. 2.11) and that there are many more important things to be afraid of, like failure, unemployment, and sin. When college girls kept diaries of their emotions for a week, 40 percent of their fears were reported in connection with school work, 31 percent in situations of inferiority and loss of prestige, and only 17 percent in connection with illness and physical danger.⁹ Primitive joys connected with acquisition of directly useful objects give way to sophisticated joys connected with symbols, such as words on paper and paint on canvas.

On the response side, emotional behavior is modified by social approval, both in amount of emotional expression permitted and in kind of expression. Some families inhibit any "unseemly display" of emotion while others encourage their children to "act natural." There are probably differences between cultures in this respect also; at least the public school English and the Plains Indians of North America seem to frown on emotional displays more than the Huichol Indians of Mexico or the Pueblos of New Mexico.

Some aspects of emotional behavior are only slightly altered by experience, especially when the stimulus is startling, but most expressions of emotion are modified in social interaction. Smiling, for example, is a natural response that matures in two or three months, but later, when the child observes how his smiles influence other people's behavior, he manipulates his smiling deliberately and works smiles, laughs, and scowls into the pattern of his verbal communication. Other emotional expressions are learned in social interaction, like a language, and a foreigner who does not know the language may make embarrassing mistakes. Most readers of this book would interpret hissing, for example, as a deliberately rude expression of disap-

proval, but among the Japanese hissing expresses polite deference to social superiors, and the Basuto applaud by hissing.¹⁰

Drives Are Modified. Like the emotions, the biological drives are modified by social interaction, both on the stimulus side and on the response side. Children are punished or threatened when they eat dirt and rewarded when they drink milk, or wine, or whatever their parents believe is good for them. As to the goal response, they are taught to eat at approved places and times with approved manners (see Fig. 3.4). Eventually in the majority of cases society wins, and eating conforms to the social norms. Chinese develop a drive for Chinese food and Germans for German food. Americans would not think of eating newborn mice any more than Hindus would think of eating beefsteak. Hunger drives in all cultures are about the same in the physiological basis and in the final goal response, but they are different in kinds of food desired, taboos on food, and manner of getting, preparing, and eating it. The thirst drive is modified by social habits in the same way but not so extensively.

The sex drive is modified by social forces even more than hunger and thirst. Preparatory activities, such as courting, are greatly influenced by social customs and individual experiences, and goal activities are considerably modified also. All cultures, from New Guinea to New England, impose some restrictions on sexual activity.

Communications Are Controlled. Knowing the general principles of social motivation, we can now understand some peculiarities of that special form of social interaction, communication of emotions and motives. Why do people sometimes talk openly about their hopes and fears and sometimes hide them? The very young child does not communicate, of course; his psychodynamics are expressed by spontaneous behavior, such as crying, laughing, approaching, and avoiding, but, as we have seen, he soon becomes sensitive to the effects of this behavior on other people. He then adjusts his expressive behavior to the social situation. If he is among friends and does not fear social disapproval, he is likely to express his feelings frankly; his verbal communications about his conscious experience will correspond with his behavior and his physiology. If he is in a threatening situation, he will defend himself as well as he can by controlling his expressive behavior, by inhibiting and disguising his feelings and intentions in accordance with the impression he wishes to make. It is a discriminating control: In front of the teacher he inhibits expression of some motives, in front of his parents he inhibits others, and in front of his friends he inhibits motives that are contrary to the group norms. In one experiment on this topic several groups of college men were first shown pictures of attractive sexual stimuli and then asked to write stories about some ambiguous pictures involving men and women. The groups that did this under ordinary conditions put relatively



Fig. 3.4. Eating habits in Japanese, American, and Eskimo cultures. The similarities are due to the common biological drive; the differences are due to the different social norms of the three cultures. (Above, The Japan Society, New York; opposite, top, from Rauschenfels, Duluth; bottom, from the film *Land of the Long Day*, produced by the National Film Board of Canada)

few responses indicating sexual motivation in their stories and many responses indicating anxiety and guilt. The group that did the experiment at a fraternity beer party showed more sexual responses and less guilt.¹¹

This control is not only inhibitory. The stage is a good example of a social situation in which communication of psychodynamics is emphasized. The actor's motive is to play his part convincingly, but that motive does not show; the motive he expresses may be love, hate, sympathy, or ambition. The amateur actors in the drama of daily life also put on emotional expressions, as well as they can, when conformity requires it or when other rewards are promised. When your dancing partner steps on your new shoes and kicks your tender shins, you smile and say you are thrilled. Even eating may be an expression of politeness rather than a goal response. As a general principle of psychodynamics, we can say that many emotional expressions that were reflexes in children become instrumental communications in adults, preparatory steps toward some social goal.

This relation between communication of feelings and social disapproval

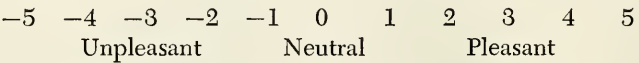


has important consequences for psychological methods. One consequence is that when people report emotions and motives on printed tests and questionnaires, these communications cannot be taken at face value. One can get a low score on a test of anxiety, for example, because he is not anxious or because he is not frank. Another consequence is that when someone comes to a clinical psychologist or psychiatrist for help with his personal problems, he usually finds it difficult at first to talk frankly about his troubles because he has learned to repress certain motives. But he is not criticized no matter what he admits, so, if all goes well, he learns to report his feelings, even the nasty ones, without inhibition or exaggeration.

Preferences: Specific and Abstract

From this review of psychodynamics it should be obvious that the attractiveness, or goal value, of any particular object or activity could depend on several biological motives and a variety of social motives. Preferences for clothes, for example, are associated with homeostasis, sex, social disapproval, and the achievement motive. Even when it is not possible to disentangle the complex origins of an individual's preferences, it is possible to analyze them, to compare one individual with another in these respects, and to use this information to predict subsequent behavior. In fact this is a common strategy for studying the dynamics of adult behavior. The question of the direction of behavior becomes one of positive or negative preference, and the question of activation becomes one of the intensity of the preference.

Ratings of the attractiveness of various objects can be obtained by simple questions—if there is no reason to distort the answers. “How attractive is apple pie to you?” “How pleasant or unpleasant is apple pie to you?” “How much do you like or dislike apple pie?” Rating scales like the following are often used.



The table below shows how a few foods were rated by one female college junior. Maximal pleasantness is rated 5 and maximal unpleasantness -5. The neutral or indifference point is 0. Compare your ratings with hers.

	Her Rating	Your Rating
Apple pie	5	_____
Waldorf salad	-2	_____
Ripe olives	-1	_____
Stewed prunes	0	_____
Liverwurst sandwich	3	_____
Garlic toast	-4	_____
Biscuit with honey	2	_____

The success of any dish, as every good cook knows, depends not only on the nature of the ingredients but also on the amount of each. Even the ratings of a simple fruit drink go up and down as the concentration of sugar is increased¹² (see Fig. 3.5). It is standard practice in many food factories to prepare several variations of a new product and have them rated by a sample of prospective customers, then to market the one with the best average rating.

Preferences for more complex objects, activities, ideas, and symbols have been studied by psychologists under such names as interests, values, and attitudes. The information obtained may be used for immediate practical purposes, as in making vocational decisions and planning political and ad-

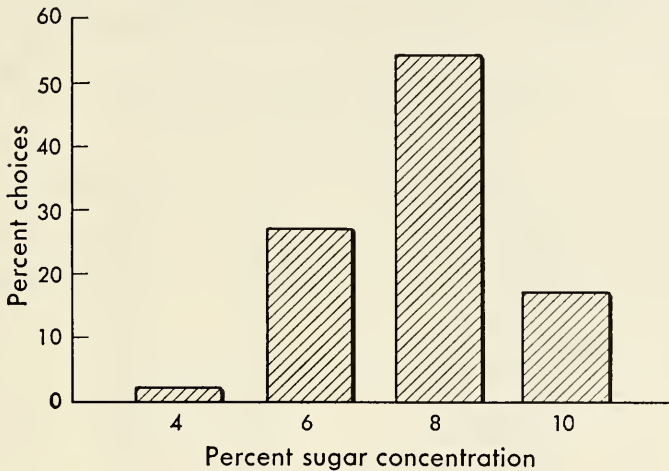


Fig. 3.5. Sweetness and flavor preference. About 20 selected judges were given four cups of apricot nectar with different amounts of sucrose added, and each was asked to choose the drink with the most apricot flavor. The sugar had a strong influence on the flavor preferences, with the optimum being around 8 percent. (Data from Valdés, Simone, & Hinreiner¹²)

vertising campaigns, or for scientific investigations of the development of motivation and personality.

Interests. An *interest* is an attraction toward, or habit of attending to, an object or activity. We have seen how babies develop an interest in people because people do things for them. They may also develop a negative interest or aversion to some objects because of punishment connected with them. In addition, an activity may be interesting for its own sake, not merely as a means to some other goal. The child who learned to like people when he was dependent on them may later like people for their own sakes and enjoy the social interaction itself, not just to get something out of other people. Interests develop and change in so many different ways that the origin of the interests usually cannot be traced. The strongest interests, naturally,

are those that are associated with several biological and social motives.

The best way to find out what people are interested in is, of course, to observe them and record the time they spend on various activities, what they attend to, and what they talk about. Psychologists have stationed themselves in museums, on street corners, and near advertisements to record the amount of time people spend observing the different aspects of the environment and talking about different topics. Listening in on conversations on street corners and in lobbies of office buildings, psychologists have noted, for example, that men talk mostly about money and business, while women talk mostly about clothes, home decoration, and people.

Thirty years ago several college students sat in on 500 bull sessions and recorded the 2000 topics that were discussed.¹³ These are shown as percentages in Table 3.1. Would the percentages be different today?

TABLE 3.1. Topics Discussed by College Men and Women in Bull Sessions

Topics	Men	Women
Dates	6.8	8.0
Fraternities	5.7	2.4
Sports	4.8	2.1
Dancing	4.6	4.1
Clothes	4.2	4.7
Drinking	4.0	1.0
Campus politics	3.8	2.1
Money	3.4	3.6
Week-end trips	3.4	2.9
Studies	3.1	2.2
Summer employment	3.1	1.9
Food	2.9	4.3
Sororities	2.9	4.7
Grades (scholarship)	2.9	1.4

SOURCE: Stoke & West.¹³

Advertising research agencies like to know about people's interests, and they spend considerable time and money to find out about them. They count the minutes people spend looking at pictures in magazines, and they count the number of people tuned in to radio and television programs. Many magazines sell their advertising space by specifying the interests of their readers; if someone is selling shotguns, for example, it is wise to advertise in a magazine read by men with hunting interests. If research shows that a large percentage of the readers are interested in safety this year, the product should be tied in with the safety appeal.

Like emotions and motives, interests are closely associated with learning. People learn and remember things they are interested in better than things they are required to learn. This principle can also be used in reverse. If

someone has a large vocabulary and a fund of information about ice fishing, he must have a strong interest in this topic.

This relation between interests and learning has been used to test the effectiveness of advertising appeals. Recordings were made of radio commercials advertising aspirin, chewing gum, shoes, and the like, using common appeals, such as economy, prestige, and sex.¹⁴ The following is a commercial that illustrates the self-esteem appeal.

FIRST VOICE: Are you going to join the throngs heading back to the old campus this year? If you are, have you checked up to make sure your teeth look right?

SECOND VOICE: You'll want them to come up to the standards of particular men and women. You'll want them to be a sparkling pearly white.

FIRST VOICE: And you'll want to be sure your breath is fresh and clean.

SECOND VOICE: We suggest you try Curtis Tooth Powder. It's the dentrifice picked by those who value the health and beauty of their teeth. Curtis Tooth Powder makes your mouth feel right.

The records were played to several groups of college students, followed by dance music, then the students were asked to recall as many brand names as they could. Since each of the 10 appeals had been used with each of the products, the average effect of each appeal on memory could be computed. Self-esteem was the strongest and comfort the weakest, as follows:

- | | |
|-----------------|---------------|
| 1. Self-esteem | 6. Efficiency |
| 2. Prestige | 7. Economy |
| 3. Health | 8. Beauty |
| 4. Universality | 9. Safety |
| 5. Sex | 10. Comfort |

Young children, as any baby-sitter knows, approach the world with open-mouthed enthusiasm. They are indiscriminately interested in almost everything within their grasp. They become selective, however, as they grow older. By the age of 10 boys reject activities they think they have outgrown, like playing school, and activities that can be called sissy, like dancing. Girls of 10 reject strenuous activities and activities that seem like masculine aggression.¹⁵ Their interests narrow also as they become critical of their performance. Young children draw and sing and play all kinds of games, but around 10 or so they lose interest in the activities that they do poorly and concentrate on those that they do well. Those who draw well like to draw; those who sing well like to sing. Thus at high school age and later there is a correlation between interest and ability, but the relationship is not close and there are many exceptions.

Vocational interests are related to abilities in the same way. A girl who can swim well is more likely to be attracted to the job of teacher of physical education than one who cannot swim. But most boys and girls are not

familiar with the specific duties and the specific abilities required on the job. Vocational interests are usually acquired secondhand from books, movies, and anecdotes and may therefore reflect a level of aspiration more than a genuine attraction to the job itself. Thus up to age 25 there is considerable shifting of vocational interests as boys and girls acquire more detailed information about occupations. For example, up to age 10 many boys want to become cowboys and many girls want to become movie actresses. Between 10 and 15 these juvenile interests decline sharply. After 25 vocational interests are fairly well established as a rule.

When people have nothing to hide, their interests can be assessed by

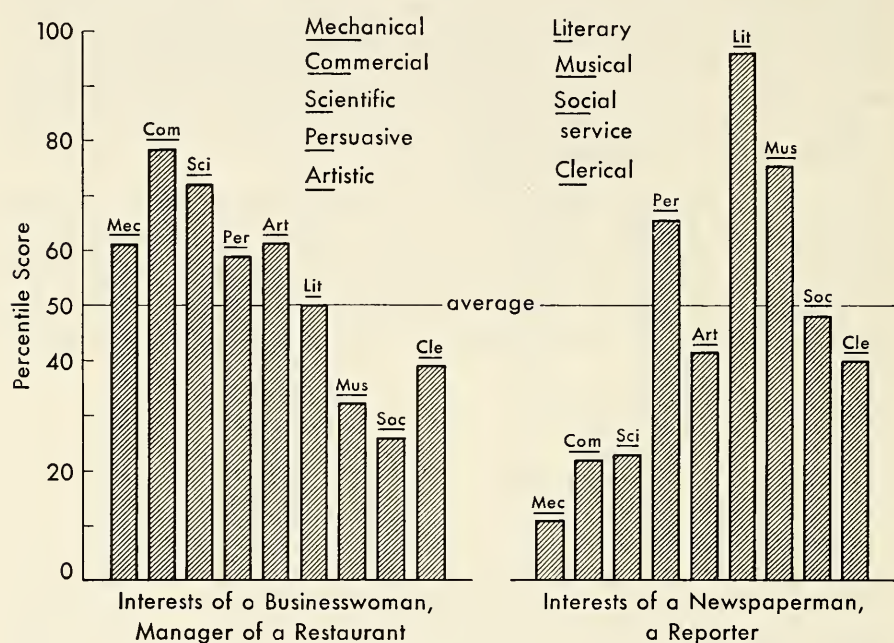


Fig. 3.6. Interests of two people analyzed into nine factors. (Data from Kuder Preference Record¹⁶)

printed tests that ask many questions about likes and dislikes. Which of these three activities do you like most? Which do you like least?

- Selling tickets to a dance
- Planning the musical program for a dance
- Writing about a dance for the school paper

The answers to such questions can be arranged so as to give scores for several broad classes of interests, such as persuasive, musical, and literary. Fig. 3.6 shows the scores of two people on a test of this kind, the Kuder Preference Record.¹⁶ The results of an interest test can also be arranged to indicate the similarity of a person's interests to those of people in an occupation. If a student fills out the Strong Vocational Interest Blank and gets

A for architect, this means that his interests are similar to the interests of practicing architects. This does not say much about his ability; it does indicate that, if he succeeds in becoming an architect, he will enjoy it.

Values. *Values* are abstract goals, like truth, goodness, and beauty. Since they are abstract, in contrast to concrete goals like food and toys, values are not important to young children. Their likes and dislikes are specific and realistic. But around the home and in school and church they hear certain abstractions praised and others denounced.

Politics is bad; business is good.

Business is stupid; beauty is the true goal of life.

Beauty is extracurricular stuff; science is the required course that the world must take.

High school boys and girls are influenced by the values illustrated in books, movies, and television as well as by those endorsed by their peers and by the adults they admire. College changes the values of some students also.

Since values are abstract goals, described verbally, tests of values simply ask people what they admire, or what impresses them, or what they consider important. Most people do not disguise or inhibit their values; they are proud of them and they find it hard to understand people whose values are different.

When you go to a football game, which impresses you most?

1. The number of people who pay to get in.
2. The intricate visual patterns made by the brightly colored uniforms lined up on the green turf.
3. The peculiar function of athletics in modern education.

One widely used test, the Allport-Vernon-Lindzey Study of Values,¹⁷ asks questions of this kind and gets scores for six values: theoretical, economic, political, social, aesthetic, and religious. Men value the first three more than women do. Women score higher on the last three than men. As one might expect, business students score high on the economic value and low on the aesthetic value (see Fig. 3.7). Students of drama and literature score high on the aesthetic value; science students are above average on the theoretical value.¹⁸

The most important influence of values shows up when decisions are made, as when the city officials have to decide whether to build a municipal swimming pool or a museum. If you were on the school board in your town and had to vote on allotting a certain sum of money to driver training or to instruction in French, which way would you vote? Is it more important for your college to have a first-rate basketball team or a first-rate map library? If we know the strength of someone's achievement motive, we know how

hard he will work to achieve success. If we know his values, we know what he considers worth achieving.

Attitudes. As psychologists use the term, an *attitude* is an orientation toward or against some goal or symbol, such as a program, an institution, a political party, a person, or a group of persons. A person's attitude toward

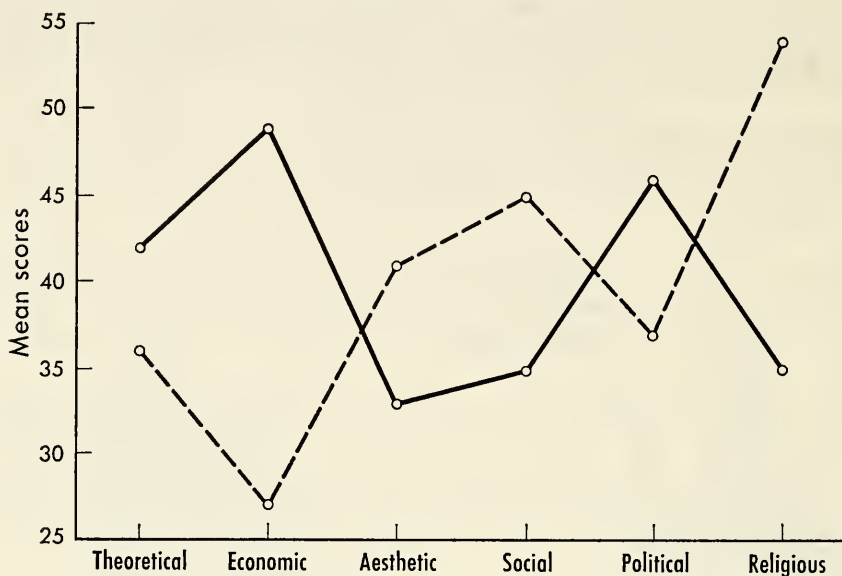


Fig. 3.7. Average values of students of theology (broken line) and students of business administration (solid line). (Data from Allport, Vernon, & Lindzey¹⁷)

labor unions will often come out in conversation if you can steer the conversation around to that topic. Direct questions are often used:

Are you in general agreement with the President's policies?
Should the United Nations have a regular police force?

Some attitude scales include a series of statements, focused on a controversial issue, to be approved or disapproved.

Most poor people have too many babies.
Parents of large families deserve a bonus from the state.
Artificial birth control is immoral.
Research on convenient methods of birth control should be speeded up.
There will never be too many people in the world.
Birth control information should be made more freely available to all.

People develop favorable attitudes toward anything that appears to help progress toward a goal and negative attitudes toward anything or anyone that gets in the way. If someone has unpleasant experiences with an insurance salesman, he may develop a negative attitude toward that insurance

salesman and perhaps toward insurance salesmen in general. In addition many attitudes about people come, not from direct experience, but from stories, cartoons, and movies about people. Attitudes toward political, economic, and social programs and symbols are often learned indirectly, from parents, school, newspapers, and books. If a person considers himself part of a labor union or business or professional organization, his attitude on political and economic matters is strongly influenced by the official attitudes of this group. And, on the other hand, if someone rebels against his parents or his organization, he may reject their programs as well. Whatever the origin may be, many attitudes are generalized. Someone who opposes government ownership of utilities probably opposes government health programs. One who favors censorship of books usually favors curfews and other restrictive proposals.

One attitude of particular psychological importance is attitude toward other human beings, or faith in people. This is tested by asking such questions as the following:

Some people say that most people can be trusted. Others say you can't be too careful in your dealings with people. How do you feel about it?

Would you say that most people are more inclined to help others, or more inclined to look out for themselves?

College students who get low scores for faith in people believe that "the general public is not qualified to vote on today's complex issues" and that "there's little use writing to public officials because often they aren't interested in the problems of the average man." These general attitudes affect the decisions people make about their own lives, because one study of thousands of college students showed that those students preparing for jobs in sales, business, public relations, and engineering have less faith in people than students preparing for social work, personnel work, teaching, science, and government.¹⁹

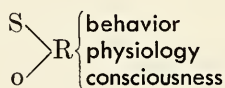
In any event, as the ordinary person moves through the world, participates in conversations, and reads the evening paper, he comes across many objects and symbols that arouse his favor or his opposition. Psychologists and sociologists have investigated the origins and distribution of many social, economic, and political attitudes, and this information will be helpful in later chapters on the individual's relation to his social environment. Knowing a person's attitudes on some general issues, we can make a fair guess as to how he will vote on pertinent questions, which side he will defend in an argument, and what decisions he will make in critical situations.

People who have something to sell, whether it is an automobile or a toothpaste, are professionally concerned with the psychodynamics of the buyer's decision. Advertising research agencies have potential customers rate brand

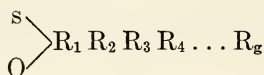
names as to appeal, and they also test attitudes toward the manufacturer of the product (Do you believe big automobile companies spread prosperity?), customers' interests (When you step into a friend's car, what do you notice first?), and even the "personality" of the product (Which is the automobile of snobbish women?). This information may be obtained by direct questions or, during a casual conversation, by noting the references to economy, to the glamour of a neighbor's car, to the manufacturer's labor policies, and to other points that might influence a decision to buy. Such information can be used in planning an advertising campaign and in redesigning the product.

PRACTICE PROBLEMS

19. Mrs. Stone was unhappy because her baby sucked his thumb, so she painted it with a bitter chemical. From the principles stated in this chapter predict what the baby did next.
 - a. Refused to eat.
 - b. Became sleepy.
 - c. Became a bed-wetter.
 - d. Sucked the other thumb.
20. Respiration is one drive that is not modified by experience. True or false?
21. If we take the diagram below as a diagram of emotion, which part is modified least by learning?



22. If we take the diagram below as a diagram of activity motivated by hunger, which part is modified most by learning?



23. If a person talks about his troubles to strangers, what would you suspect?
 - a. He is an unusually frank person.
 - b. He is not talking about the important troubles.
 - c. He has learned how to control his emotions.
 - d. He does not have any serious troubles.
24. In the experiment with the apparatus shown in Fig. 3.1 records were kept of the children's spontaneous social interaction, such as comments, questions, and attention-seeking behavior. When would you expect such spontaneous social activity to be more frequent: after deprivation or after nondeprivation?

The following items might be found on tests of interests, attitudes, or values. Mark each Int, Att, or Val to indicate which kind of test it belongs in.

25. _____ How often do you read the market reports?
26. _____ Would you rather hunt deer or photograph them?

27. ____ Which is the more desirable achievement, clear language or clean language?
28. ____ Most labor leaders are crooked.
29. ____ The most important part of a college education is learning (a) about people; (b) the great ideas of Western civilization; (c) how to make a living.
30. ____ Do you believe that big corporations hire lawyers to help them cheat on taxes?
31. ____ Airlines should pay for their own airports.
32. ____ During class I usually work crossword puzzles.
33. ____ I would rather be right than be president.

Fig. 3.8 shows the average scores of two groups of public health nurses on the Allport-Vernon-Lindzey Study of Values.²⁰ Each group participated in a special mental health program for two years during which they could make use of experts

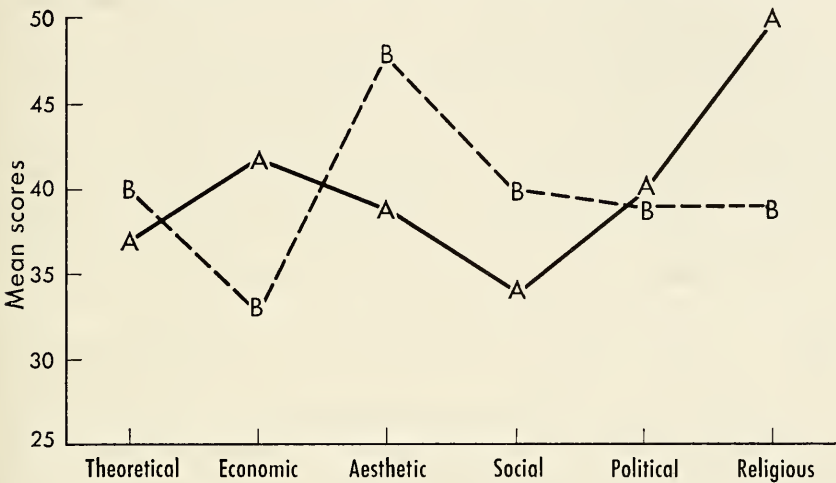


Fig. 3.8. The graph shows the average scores of two groups, A and B, of public health nurses on the Allport-Vernon-Lindzey Study of Values. Each group participated in a special mental health program for two years during which they could make use of experts and learn new methods. Using what you have learned in preceding chapters try to answer questions 34-39. (Data from Kline & Cumings²⁰)

and learn new methods. Using what you have learned in preceding chapters try to answer the following questions.

34. ____ Which group was more conservative in general?
35. ____ Which group would be more interested in new methods of public health nursing?
36. ____ Which group learned more about mental health?
37. ____ Which group participated more in new programs?
38. ____ Which group expressed more dissatisfaction with their jobs?
39. ____ Which group would you guess was more intelligent?
40. When nursery school children, age two to four, are asked to draw something, which sex will draw more persons, boys or girls?

College students were given a test of values and a test of vocational interests.²¹ Those students who placed a high value on freedom were more interested in which of these jobs? (Mark each Yes or No.)

41. _____ Army officer.

42. _____ Artist.

43. _____ Banker.

44. _____ Business manager.

45. _____ College professor.

46. _____ Poet.

Preparation for Action

We have to study reflexes, emotions, motives, and values one at a time because we cannot study everything at once. Likewise, when we test motives in the laboratory, we try to simplify the conditions so that we can test each one separately. When we test the achievement motive, for example, we try not to arouse hunger or fear. In contrast, the complex situations of ordinary life offer the individual many attractive goals and arouse many motives at the same time. But the normal individual does not obey every biochemical whimsy, and he does not chase all social goals at once. Nor does he respond to every stimulus, like a leaf blown this way and that by every gust of wind. If we watch him, we can usually see that his behavior is integrated. He prepares his activities in advance, then responds to pertinent stimuli and ignores others. The mechanism that integrates his behavior from moment to moment and steers a course of action through the stimulating sea of objects and people is called the *set*.

The set is usually defined as a readiness to make a specified response to a specified stimulus. By "readiness" we mean that the response is prepared before the stimulus is perceived. As an illustration of set, suppose you ask a friend to underline all the *e*'s on this page. If he is agreeable, he will get set to observe *e*'s. The *e*'s are the specified stimuli. He will take out a pencil and get set to underline. Underlining is the specified response. Note also the negative or inhibitory side of the set. When one is prepared for *e*'s, he ignores *a*'s, *b*'s, *c*'s, periods, commas, and the meanings of the words. He inhibits all the responses he is capable of making to *e*'s except the underlining response. Note also the sequence of acts. When he sees an *e* and underlines it, he does not stop and wait. He looks for another *e* and makes another response. He keeps going as long as the set persists. This is what gives behavior its characteristic continuity.

Suppose now you ask your agreeable subject to draw vertical lines through all the *a*'s on the page. He will shift set and get ready to make a different response to a different stimulus.

The stimulus side of the set, the readiness to perceive a certain stimulus, goes by the name of *attention*. When we investigate attention, we put the emphasis on the stimuli to be perceived and make the response as easy as

possible. One way to do this is to have the subject simply report the number of things he perceives. To try this on yourself, get ready to turn the page, count the *i*'s in the top line on the next page, and turn back to this page. Get set. Go. You probably counted the *i*'s correctly, but how many *o*'s were there? When experiments like this are carefully performed in the laboratory, it always comes out that the subject can best describe what he is set for; other things in the environment are not noticed clearly. To see the relation between the center of attention and the periphery, aim a quick glance at the *X* in the line of letters below:

nmlkjihgfedcbaXabcdefgghijklmn

A letter near the main target, in the position of *a* or *b*, is usually identified with almost 100 percent accuracy, while a letter a little off center, as at *g*, is identified with about 70 percent accuracy, and in the *m* position only about 40 percent.

The set itself is a response. But it is a preparatory or instrumental response rather than a goal response. The alertness or activation of the organism shows in the brain-wave pattern (see Fig. 2.3), and there are external signs also. When someone gets set to underline *e*'s, he looks where he expects to see *e*'s and he holds his pencil in readiness. His muscles are more tense than when he is not set, especially the muscles of the arm that holds the pencil. How is this important preparatory response or set established? The chief factors that influence the set can be described under four headings: motives, social interaction, previous experience, and the present situation. All of these factors operate simultaneously, of course, but it is possible to arrange experiments in which each can be studied separately.

Motives. When a robin has been without food for a day, he is set to perceive food stimuli and to perform the appropriate goal response. During the mating season hormones in his blood sensitize perception to the sight and sound of a female robin and prepare the mating response. Likewise a person eager for social approval gets set to observe the actions of other people and particularly their reactions to his own actions.

The drives, motives, values, and attitudes that we have described determine the long-term policies and goals of the individual. The set is the short-term readiness for specific stimuli and responses at any moment. When only one motive is aroused, this motive naturally controls the set. Attention is directed mainly toward the goal of the moment and secondarily toward other things. If the motivation is increased, attention is even more centralized and objects in the periphery are ignored²² (see Fig. 3.9). When two or more motives are aroused, the situation is more complicated—as we shall see in Chapter 9. In any case the relation between motives and set is analogous to the relation between the board of directors of a large corpora-

tion and the general manager. The directors establish policies and goals, and the manager executes them in accordance with the immediate situation.

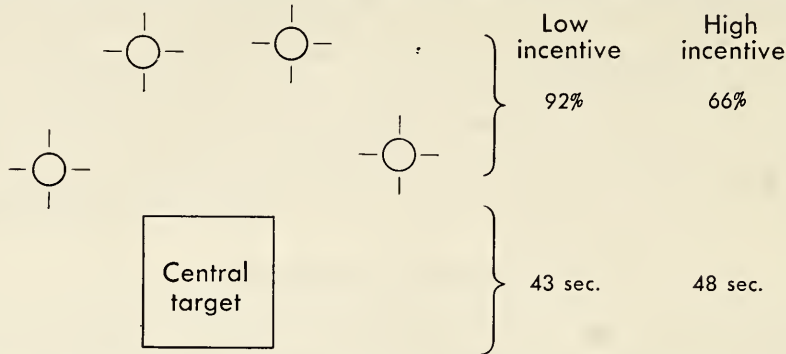


Fig. 3.9. Performance on a central task and a peripheral task. The central task was to hold a control knob on a moving target, and an electric clock recorded time on target. Meanwhile little lights came on in a semicircle two feet from the subject. Under ordinary low-incentive conditions the subjects were able to follow the target 43 seconds out of a minute on the average and 92 percent of them noticed the peripheral lights. When motivation was increased by an offer of bonuses up to three dollars for good performance on the central task, attention narrowed to the central task, the average score went up to 48 seconds, and only 66 percent noticed the peripheral lights. (From Bohrick, Fitts, & Rankin²²)

Social Interaction. At a track meet the starter tells the runners, "Get set." And they do. They get set to make a specified response, sprinting, when they hear a specified stimulus, the pistol shot. Behind this behavior there are certain motives that we may take for granted. The runners are motivated

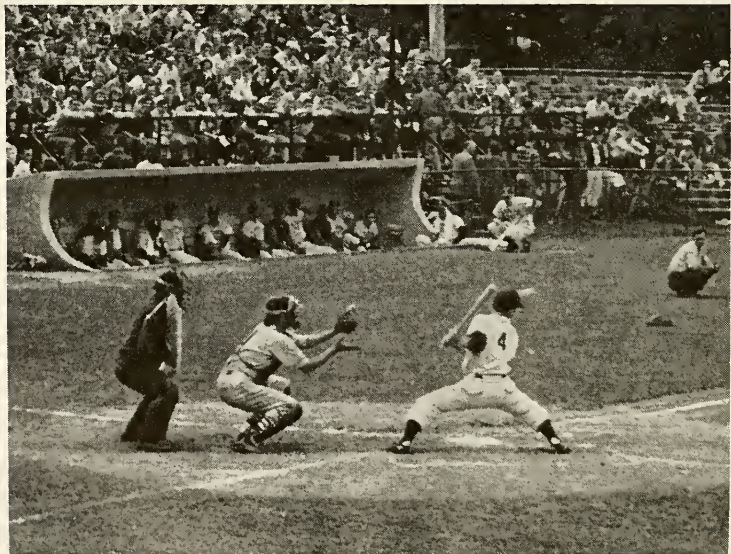


Fig. 3.10. Set and posture. The umpire, the catcher, and the batter are all set to perceive the same stimulus, but each is set to make a different response. (MSU Information Services)

toward athletic achievement, or they would not be in the race. They are motivated by social approval to conform to the rules of the sport. Each competitor probably has some individual motives that we cannot identify. The instructions from the starter integrate these motives at the proper time so that the response is made with precision and speed (see Fig. 3.10).

At a beauty contest the manager tells the judges: "When the girls walk by, rate each from 1 to 5 in respect to gracefulness." And they do. They get set to observe a certain quality, gracefulness, and to make certain marks on their score cards (see Fig. 3.11).

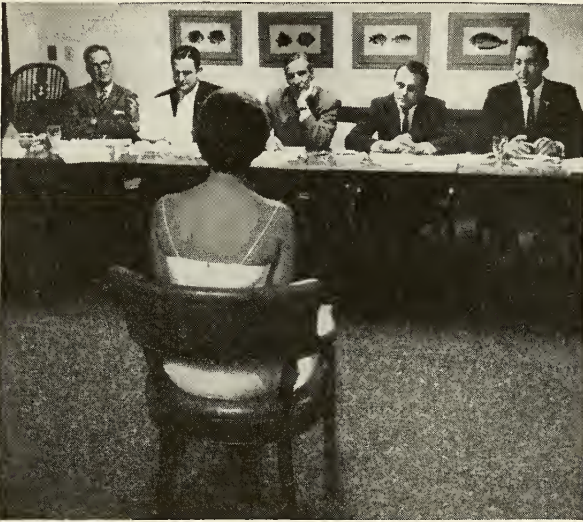


Fig. 3.11. Set and judgment. The judges, picking a bowl queen, are set to observe certain qualities, such as beauty and poise, and to make certain marks on their score sheets. (Larry Fried, PIX)

In these two examples the runners and the judges get set to carry out rather complex patterns of behavior as a result of social interaction or communication. This is the most common way of influencing behavior. We do not usually inject a motive into someone. We assume that he has a variety of motives, and we say some words or make some gestures that activate some motives but not others, so that when a specified stimulus occurs, he makes the response we desire. Many of the techniques of the psychologist, in the laboratory and in the testing room, require the subject to adopt a certain set, and his responses are evaluated on the assumption that he has followed instructions.

The instructions may, of course, go counter to some strong motive. Suppose you ask a friend to get ready to jump out the window when the bell rings. He could do this, but he won't. The board of directors can overrule the manager.

The effects of social interaction are not limited to direct instructions. If you look up at the sky, hold out your hand, and scowl, someone else may get set to observe rain clouds also, and may even report feeling a drop of rain. This is called social *suggestion*. If you taste a glass of milk, screw up your mouth, and make a wry face, someone else may say that it tastes sour to him also. In fact, much of the social behavior of civilized human beings depends on these indirect interpersonal cues. At parties, dances, committee meetings, classrooms, and weddings subtle hints are picked up from conversation, gestures, and the general atmosphere, so that when someone makes a signal, others are ready for the approved response.

Previous Experience. When you learned to drive a car, you were probably instructed to watch the traffic lights and to be prepared to push the brake when the light is red. After you had stopped at the red light, you were told to be prepared to push the accelerator when the light changes to green. Now, having done this many times, you automatically adopt the appropriate sets when you approach an intersection. You do not have to be instructed each time. Whatever your goal may be, when you get behind the wheel, you reinstate the sets you have previously adopted in this position. The experienced sprinter likewise gets set for the race easily because he has done it often before. As we go through the familiar routine of daily life, we are prepared for most of the stimuli we encounter. In these cases the set is a habit, a complex kind of habit, the mastery of which will be considered in the chapter on learning.

Some complicated skills require shifting from one habitual set to another. Reading music is a good example. When a musician sees the treble clef, he gets set to make certain responses to the symbols that follow. If he then sees a bass clef, he quickly shifts set and makes different responses to these symbols. He shifts easily from one to the other because he has practiced both. We shall make much use of the principles of set in later chapters and we shall see that a well-practiced set can lead to errors as well as to success.

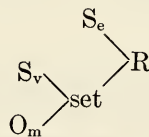
The Present Situation. What happens when we encounter new stimuli or a new situation for which we are not prepared? Since we are not prepared, almost anything can happen. It depends on the nature of the new stimuli, for some are more compelling than others, and on the strength of the previous set.

If the new stimuli are intense, such as bright lights or loud sounds or strong smells, they capture the individual's set, whatever he may have been doing previously. Moving objects, objects that contrast with their backgrounds, and sudden or intermittent sounds are particularly compelling in this respect. Attention is redirected to these attractive stimuli. The same thing happens if the new stimuli arouse a motive, interest, or value. Suppose someone is walking down the street when two cars come together with

a crash. Whatever he may have been doing, he will stop and look. If the events arouse no additional interest, he will continue doing what he was prepared to do. But if he sees a friend in one of the cars, or if social approval compels him to give aid, or if he has a special interest in automobile accidents, his previous set will be overcome and his attention will remain with the accident. We can say, in general, that attention, or the set, is captured and redirected by intense stimuli, stimuli that contrast with the background, and stimuli that arouse a motive.

The advertisers are the most eager practitioners of this phase of applied psychology, as one can see by leafing through the advertising pages of any magazine with a large circulation. Notice the advertisement that first captures your attention and stops you from turning the pages. Then analyze it according to the principles developed above. You will see bright colors and strong contrasts, with the important objects standing out sharply from their backgrounds. Then notice how your motives are aroused, once the mechanical features of the layout have attracted your eye. Beautiful girls, handsome men, steaming food (in winter), cool drinks (in summer), undressed babies, fires, accidents, animals, and legs are commonly used to hold your attention a little longer and direct it toward the advertiser's message.

If we wish to put the set in our S-O-R formula, two stages are necessary. Consider the example of underlining *e*'s in response to a verbal request. The first stimulus is the verbal stimulus, S_v , that the individual hears. If he has the appropriate motive, O_m , he makes the appropriate response. But in this case the response is a preparatory response, a set. With this set he opens the book, sees an *e*, and makes the underlining response.



Thus we must say that in their effects on the response stimulus variables and organismic variables are not always independent. They may interact. The set, an organismic variable, determines which stimuli are effective. And, in reverse, stimulus variables influence the set and other organismic variables.

SUMMARY

Man does not live by bread alone. Since the human infant is dependent on others for many years, he acquires a motive for social interaction. Since he is differentially rewarded and punished by others, he becomes sensitive to

the effects of his behavior on others and thus acquires a motive for social approval. He also acquires some ambition or motivation for achievement, presumably due to cumulative successes and failures and his interpretation of these in the light of family expectations. When they are adults, people differ greatly in the strength of these motives; in fact they can be considered dynamic personality traits.

As the child matures, he begins to control his behavior, usually because of social disapproval. Some reflexes, and emotions, when inhibited, acquire the properties of drives, and even biological drives are modified to conform to the social norms. Adults exercise considerable control over their verbal and facial expressions of emotions and motives; hence these communications do not always agree with behavior and physiology.

Because of these psychodynamic principles, and unknown others, many objects, activities, and symbols acquire positive and negative significance as goals. Most things, of course, are neutral. Objects and activities that one enjoys are called interests. Abstractions that one prefers above others, such as liberty, are called values. An orientation for or against some symbol or person is called an attitude.

Behavior gets its continuity from the set, which is a readiness to make a certain response to a certain stimulus. The readiness for the stimulus is called attention. The set may be considered as a short-term mechanism executing the long-term policies of the motives and values. The set is influenced also by instructions from other people and by practice. When the individual is not set for anything in particular, his attention is captured by intense stimuli, changing stimuli, and stimuli that arouse a motive.

PRACTICE PROBLEMS

47. Which is the sharpest difference between emotions and motives?
 - a. Emotions are secondary; motives are primary.
 - b. Motives are learned; emotions are innate.
 - c. Emotions are organismic; motives are localized.
 - d. Motives organize a set; emotions disrupt the set.
48. In one experiment on set Group A saw words like "whale," "shark," "salmon," "porpoise," and then "sael." Group B saw words like "deck," "water," "mast," "gangplank," and then "sael." Most of one group perceived the misspelled word as "sail," and most of the other group perceived it as "seal." Which group perceived it as "seal"?
49. What principle of set is illustrated by this experiment?
 - a. Effect of motivation.
 - b. Effect of social interaction.
 - c. Effect of previous experience.
 - d. Effect of startle.
50. In an experiment on reaction time the subject is told to get ready, then the stimulus (a light or a sound) comes on, and the subject hits a switch that stops

the clock as fast as he can. "Ready" S R. When do you suppose the subject gets set?

- a. At the "ready" signal.
 - b. After the "ready" signal and before the stimulus.
 - c. At the time of the stimulus.
 - d. After the stimulus and before the response.
51. Guess which preparatory interval between "Ready" and S would give the fastest R: (a) 0.2 second; (b) 2 seconds; (c) 1 minute; (d) 2 minutes.
52. In an experiment on word association the subject is given a stimulus word and asked to give a word that has some association with it. The first three stimulus words in one experiment were "sharp," "destroy," and "loquacious." One subject gave the response words "acute," "ruin," and "garrulous," while another subject gave "blunt," "construct," and "taciturn." Can you explain the difference?
- a. There were individual differences in vocabulary.
 - b. One subject must have had more practice.
 - c. The subjects were instructed differently.
 - d. The subjects had different motives for taking part in the experiment.

In experiments on set which of these variables would be independent variables and which would be dependent variables? Mark each Ind or Dep.

- | | |
|---------------------------------|-------------------------------------|
| 53. _____ Instructions. | 56. _____ Preparatory interval. |
| 54. _____ Time of response. | 57. _____ Kind of response. |
| 55. _____ Sequence of problems. | 58. _____ Tension in subject's arm. |

Which of the terms used in this chapter refer to observable events and which refer to psychological constructs? Mark each Obs or Con.

- | | |
|-------------------------|------------------------|
| 59. _____ Ready signal. | 63. _____ Attitudes. |
| 60. _____ Set. | 64. _____ Approaches. |
| 61. _____ Instructions. | 65. _____ Withdrawals. |
| 62. _____ Values. | |

66. What method was used to obtain the data of Fig. 3.8?
- a. Experimental manipulation of motivation.
 - b. Comparison of experimental and control groups.
 - c. Comparison of known groups.
 - d. Controlled strengthening of certain goals.
67. Guess whether reaction time is faster with a constant or a variable preparatory interval.

When one scale of attitude toward the church was constructed, many people were asked to judge statements on a scale from 0 (extremely favorable to the church) to 11 (extremely opposed to the church). Average scale values for four statements are as follows:²⁵

- 0.5. I feel the church is the greatest agency for the uplift of the world.
- 5.5. Sometimes I feel the church is worth while, and sometimes I doubt it.
- 7.2. I believe that the church is losing ground as education advances.
- 10.6. I regard the church as a parasite on society.

Rate each of these statements on the same scale:

68. _____ There is much wrong in my church, but I feel it is so important that it is my duty to help improve it.
69. _____ I am sympathetic toward the church, but I am not active in its work.
70. _____ The church deals in platitudes and is afraid to follow the logic of truth.
71. Students who had high faith in people and students who had low faith in people were asked whether they considered it important to get ahead in life. The results are shown in the table at the right. Which column gives the percentages for the high-faith group, X or Y?
- | | X | Y |
|--------------------|-----|-----|
| Very important | 38% | 57% |
| Not very important | 62 | 43 |
72. The Study of Values described in this chapter has been revised for use in research on magazine readership.²⁴ It was found that women with high scores on a certain value were more interested in the articles on science and science fiction than the ones on domestic arts, religion, and romantic fiction about love, home, and children. Which value?
73. If we know an individual's values, we can predict which of several programs (a) he will succeed in; (b) he will give priority to; (c) will interest him; (d) has influenced his life.

Discussion Questions

- A. When we speak of a strong motive, what precisely do we mean by "strong"?
- B. What factors in addition to the achievement motive influence college grades?
- C. When the average college student is sitting in class listening to a lecture, what is he set to observe and how is he set to respond?

Recommended Reading

- D. C. McClelland. *Studies in motivation*. Appleton-Century-Crofts, 1955. A collection of readings: theories, observations, comparisons of groups, and experiments.
- C. Kluckhohn. Culture and behavior. In G. Lindzey (Ed.), *Handbook of social psychology*. Addison-Wesley, 1954. Vol. II, pp. 921-976. A synopsis of reports by anthropologists on cultural variations in biological processes, sexual behavior, emotional expression, and abnormal behavior, as well as universal behavior.
- H. F. Harlow. The nature of love. *Amer. Psychologist*, 1958, 13, 673-685. A report of laboratory experiments, with photographs, which show why baby monkeys love their mothers, how they can be trained to cling to a wire-mesh cone covered with terry cloth and equipped with a unibreast, and why psychologists make better monkey mothers than monkeys do.
- G. Murphy. Social motivation. In G. Lindzey (Ed.), *Handbook of social psychology*. Addison-Wesley, 1954. Vol. II, pp. 601-633. A sophisticated biosocial interpretation of the development of the individual's motivation.
- M. Rosenberg. *Occupations and values*. Free Press, 1957. A study of the attitudes and values of college students and how they change during the college years.



Chapter 4. STIMULI AND SENSES

Now that we know something of the dynamics of activity in the world of grocery stores, drinking fountains, soft May breezes, and automobile accidents, we can turn our attention to the senses that put us in touch with this colorful world. Behavior, we have agreed, is determined by conditions in the organism and stimuli in the environment or, to put it graphically,

$$\begin{array}{c} S \\ \searrow \\ O \end{array} \rightarrow R.$$
 Preceding chapters have described the effects of organismic variables; now we consider the effects of stimulus variables. This chapter describes the various kinds of stimuli and the sense organs that are sensitive to each. The next chapter will consider the use that we make of this information from the sense organs.

As a rule people pay little attention to their eyes and ears, or to lights, sounds, and smells. The motivated organism observes the objects of the environment and adjusts his behavior to them, using any or all of his senses for whatever good they may do him, seldom bothering to separate vision from hearing, or taste from smell. When an automobile or a person passes by, we see it with our eyes and hear it with our ears, and respond to it, or ignore it, according to the set at the moment. But automobiles and persons are very complex stimulus objects that affect several senses at once. In order to understand how we see and hear such complex objects we have to analyze them into simple aspects or dimensions—usually under controlled laboratory conditions. Then we can discover what each sense contributes to our perception of the whole thing.

What Is a Stimulus? In previous chapters we have called a stimulus anything that one can identify, perceive, and respond to, such as a person, an apple, or a mountain. But a mountain cannot stimulate an eye. In this chapter we must use the more precise language of the physical sciences. Light rays reflected from the mountain travel through the air, through the outer layers of the eye, and stimulate the sensitive receptors in the back of the eye.

We can call the mountain the perceived stimulus, or environmental stimulus, or *stimulus object*, but the *physical stimulus* that affects the eye is the light that reaches the sensitive cells in the back of the eye. Impressive progress in this department of psychology has been made by specifying the stimulus in the terms of physics—light in terms of wavelength, sound in terms of frequency, and touch in terms of grams. Thus the capacities of the different senses are measured in terms of the physical stimuli to which they are sensitive.

It is no accident that we study stimuli and senses together. Man's sensory equipment is the result of a long evolutionary adaptation to the stimuli of the world he entered. If the stimuli in this world were different, man's senses would be different. And if man's senses were different, his description of the world would be different.

Methods. Suppose you want to test your dog's hearing. He is growing old

and you suspect that he has become deaf. When you call him, he does not always come. That does not prove that he cannot hear because he may not have learned to come every time he is called. Or he may be bored. Or he may come because he sees you or smells you, not because he hears you. One method is to clap your hands sharply near his head. If he jumps or blinks, he must be able to hear. That is, if the stimulus elicits the startle response,

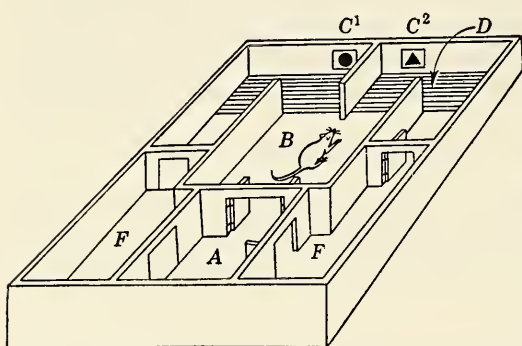


Fig. 4.1. Yerkes-Watson discrimination box. A, entrance compartment; B, discrimination compartment; C¹ and C², stimuli to be discriminated; D, electric grid; F, food compartments. (Reprinted with permission from H. F. Harlow, in T. G. Andrews, Ed., *Methods of psychology*, 1948, John Wiley & Sons, Inc.)

this response is an indicator of sensory function. The startle response, you will remember, does not require previous learning and is not much influenced by the motivational condition of the organism. This *reflex method* is rough, not suitable for precise measurement, but it has been used with infants to determine the ages at which they first hear loud sounds, see bright lights, and taste bitter foods.

A more precise method requires training in discrimination. We can train a dog, or any mobile animal, to go to a light object and avoid a dark object, for example, with apparatus such as that shown in Fig. 4.1. Beginning with a well-lighted card and a faintly lighted card, we reward the animal with food when he goes to the light card and punish him with a mild electric shock when he goes to the dark card. Most higher animals can learn such

an easy discrimination in a few trials. We shift the position of the cards often, so that the animal establishes a set to attend to lightness rather than to position. Then we decrease the difference between the two cards and test the animal again. If he goes to a very light card and avoids a moderately light card, he must be able to detect a small difference. Then we decrease the difference again, making it smaller and smaller until he begins to make errors. By this method we can test sensory capacities with considerable precision. This method, or some variation of it, has been used to survey the sensory capacities of many of the common animals, and the results of such testing can be found in the standard textbooks on comparative psychology. This method is called the *discrimination method*.

When we test a human adult, we use the same strategy. We get the subject to adopt a set, to attend to brightness, for example, and to make a certain indicator response. We ask him to say "left" if the left stimulus is brighter and "right" if the right stimulus is brighter. The indicator response in this case is not a startle response or a movement but a verbal response. More specifically, it is a *judgment* that communicates what the subject sees or hears or feels, and we use such judgments to make inferences about sensory functions. Training is not necessary because the average adult knows what "bright" means and what "left" and "right" mean. Even so, we usually start him off with a large brightness difference so he will be sure to get set for brightness rather than some other stimulus dimension like color. Then we decrease the brightness difference until we reach the smallest difference that he can discriminate. This minimum detectable difference is called the *difference threshold*.

There are many variations in method of measuring thresholds of the various senses. A subject may be given a standard light to watch and asked to adjust another light by turning a knob until the comparison light is just noticeably brighter. Or the experimenter may show several lights, some strong and some weak, each to be compared with a standard light. A triangle method is often used by psychological consultants to food manufacturers. Three soups are prepared, two the same and one with a slightly different flavor. The subject is asked to taste all three and try to pick the one that is different. Whatever method is used, the comparisons are made many times, and then the experimenter can compute how much difference there must be on the average for the subject to detect the difference.

Another threshold of considerable interest in this chapter is the *absolute threshold*. The observer is asked to taste each of several solutions which contain minute amounts of sugar and report which ones taste sweet. His absolute threshold is the minimum percentage of sugar that tastes sweet. Or he is asked to listen to a sound and adjust the volume control downward until he no longer hears it, or upward until he just barely hears it, and the

average value of these is his absolute threshold for hearing. The absolute threshold can also be considered a difference threshold because the receptors, sensory nerves, and brain are all living tissues that add their own spontaneous excitation to that initiated by the external stimulus, and the ultimate task is the discrimination of the neural excitation initiated by the stimulus from the neural excitation generated elsewhere. In general, the observer's judgments or adjustments under optimal conditions are averaged to get a measure of his sharpest discriminations.

Another method for studying sensory functions is to ask the subject to describe his sensations. *Sensations* are conscious experiences aroused by stimulation of the sense organs. They are hard to describe, but a person with a good command of the language can report the sensations he had the last time he rode a roller coaster, or when he ate a grilled-cheese sandwich with a chocolate milkshake, or when he dove into a cold lake and hit bottom. We can ask him to look at a light for a half-minute, then close his eyes and report his visual sensations for the next three minutes. This method is not very precise, because it is limited by the subject's skill in communication, but it is a useful method for preliminary analysis of the psychological effects of complex stimulation.

We can get rather precise measures of the psychological effects of stimulation from cooperative educated subjects by asking them to conceive of a psychological variable or scale and to rate the sensation on this scale. Just as a person can rate the pleasantness of a drink of lemonade on a scale from 1 to 9, he can also rate its sourness and its sweetness. Likewise he can think of a psychological scale of loudness and perhaps estimate that the effect of one sound is twice as loud, or half as loud, as the effect of another. In general, the method of *magnitude estimation* asks the observer to attend to a certain psychological variable or dimension of consciousness and to ignore others, and uses his estimates as measures of sensory functions. The physical stimulus is measured in physical units and the response is measured on a scale of psychological magnitude.

All these methods, the *reflex method*, the *discrimination method*, and the *estimation of psychological magnitudes*, have been used to obtain the evidence that will be presented in this chapter.

The Senses in General

Ordinarily one is constantly bombarded by stimuli of all sorts—lights, sounds, smells, pressures, and temperatures—impinging on the sense organs. This seems to be man's natural condition, and when this stimulation is cut off for a while, one feels very uncomfortable.¹ Hallucinations and errors of interpretation may occur.

Most of the senses operate on the same general plan. *Sense organs* are located near the surface of the body, with a few exceptions to be noted later, and somewhere inside each are the delicate receptors. *Receptors* are highly specialized cells that, as a result of a long process of evolution, are sensitive to specific kinds of stimuli. Receptors in the eye, for example, are sensitive to light. Receptors in the tongue are sensitive to chemical stimuli. These receptors communicate with sensory nerves that carry signals back to the spinal cord and brain. We can think of the brain as a communication center, collecting and integrating information that comes in from all senses. The use of this information will be the subject of the next chapter: "Perception."

Sensory adaptation occurs in all senses. A warm object on the skin feels less warm after it remains a while. A chemistry laboratory or a locker room may smell strong when first entered, but after five minutes it may not smell at all. The eye can adapt to a wide range of lights, and even a stone in the shoe feels less painful after a few minutes.

Contrast occurs in all senses. In cold weather a breeze of 60 degrees feels warm; in the summer 60 degrees feels cool. A flute heard against the background of a full orchestra sounds different from the same flute heard alone.

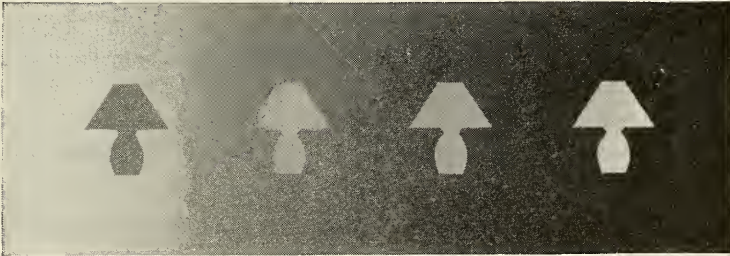


Fig. 4.2. Effect of contrast. Which lamps are lighted? To prove that the differences in apparent brightness are due to contrast, eliminate the background by viewing the lamps through four small holes in a sheet of opaque paper. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

Manipulation of contrast is a large part of the art of the cook as well as the composer. For an illustration of brightness contrast see Fig. 4.2.

Weber's Law. If you had to design a sensory instrument to help man make his way among objects of all sizes on the surface of this earth, you would want it to discriminate differences between a pin and a needle as well as between a hill and a mountain. An error of an inch is important when you are judging the height of a curb, but not when you are judging the height of a mountain. For the most part our senses operate on this principle. Laboratory experiments have shown that when many lines are compared with a line of 100 millimeters, the difference threshold is about 2 millimeters, that is, about 2 percent of the standard line. When distances around 100 meters

are compared, the difference threshold is about 2 meters, again about 2 percent of the standard. *Weber's Law* states that difference thresholds are proportional to the standard stimulus, and, within certain limits, this law is quite useful.

PRACTICE PROBLEMS

Fill in the following blanks with Jud for judgment, Sen for sensation, Stim for physical stimulus, or Obj for stimulus object.

Mr. Hennesey sat down at the breakfast table, still half-asleep. But the gurgle of the coffee pot (1 _____) was music to his ears, and the warmth of the coffee in his mouth brought him to life. When the toaster popped up, he looked at the color of the toast (2 _____) and pushed it down again: "A little too light" (3 _____). In due time the toaster popped up again and Mr. Hennesey felt that familiar crunchy sweetness (4 _____) that started his day off right.

Later Mr. Hennesey looked at the clock (5 _____) and decided that it was time to go to work (6 _____). He went out the door and walked rapidly toward the bus stop. When the cool air (7 _____) brushed his cheek, he said to himself: "Maybe I have a cold coming on; I feel shivery" (8 _____). Down the street the bus driver blew his horn (9 _____), and when the sound reached Mr. Hennesey's ears (10 _____), he quickened his pace. The horn blew again, but this time it was not so loud (11 _____), so he feared the bus had already passed his stop. Sure enough, when Mr. Hennesey reached the corner, he saw the back end of a bus (12 _____) moving away, but the cars behind it cut into his line of sight (13 _____) so he still did not know which bus he had missed.

Which of these are stimulus variables and which are responses or response variables? Label each S or R.

- | | |
|---------------------------------|---------------------------------------|
| 14. _____ Reflex. | 18. _____ Amount of sugar in a drink. |
| 15. _____ Judgment. | 19. _____ Sensation. |
| 16. _____ Discrimination. | 20. _____ Temperature of air. |
| 17. _____ Sweetness of a drink. | 21. _____ Coolness of air. |

What principle is illustrated by each of these examples?

22. One swimmer said to another: "It is not cold after you have been in a while."
23. One hunter said to another: "It is easier to track deer when there is snow on the ground."
24. Stop signs are black on yellow.
25. The second slice of bacon is not as salty as the first.
26. Mr. Hennesey lifted weights from 96 grams to 104 grams, comparing each with a standard weight of 100 grams, and the results indicated a differential threshold of 2 grams. Later he lifted weights from 380 to 420 grams, comparing each with a weight of 400 grams. If Weber's Law holds, what differential threshold would you expect?
27. Some dentists stop drilling when the patient wrinkles his brow or jerks his shoulders. Which method is he using? (a) reflex; (b) discrimination; (c) estimation of sensory magnitudes.

28. The optometrist tries several lenses on your eyes and asks you to look through each at a wall chart. Which method is he using? (a) Reflex; (b) discrimination; (c) estimation of sensory magnitudes.
29. A composer marks a score fff in one place and pp in another. Which method is he using? (a) Reflex; (b) discrimination; (c) estimation of sensory magnitudes.

Taste and Smell

Taste and smell are often called the chemical senses because of the stimuli that affect them. Many of the simple organisms that live in water are sensitive to chemicals applied anywhere on the surface of the body, but in the higher animals and man the chemical receptors are located in the mouth and nose. To excite the taste receptors the stimuli have to be in solution in the mouth and have to come in contact with taste buds a little below the surface of the tongue and adjacent parts of the throat. The receptors in the taste buds respond by sending signals about the chemicals along the sensory nerves which lead to the brain. Since the neural signals correspond in some ways to the chemical, we may say that the receptor transforms the chemical stimulus into a nerve impulse.

Tastes can be divided into four classes, sweet, sour, bitter, and salty, and the sensory areas of the tongue can be divided up in much the same way. If you dip a toothpick into a salt solution and touch it to your tongue a little behind the tip, you will not taste anything, but if you explore the whole tongue in this way, you will find that the sides and back are sensitive to salt. The four areas that are sensitive to the four classes of chemicals overlap but they do not coincide.

Absolute thresholds are measured in percent concentration. If we prepare a 1 percent solution of sucrose (a kind of sugar) by dissolving one gram in a hundred grams of water, it will taste sweet to most people. The lowest concentration that can be tasted, the absolute threshold, is about 0.7 percent. For salt the threshold is about 0.2 percent, for hydrochloric acid about 0.007 percent. Quinine sulfate tastes bitter in a concentration of 0.00003 percent.

All these thresholds are raised by adaptation, but they are practically back to normal after a half-hour rest. Thresholds for most chemicals are raised or lowered by temperature changes. After reading Chapter 2 one might suppose that an animal would have a lower threshold for salt when he is deprived of salt. This is probably not true, however. When electrodes are applied to the nerves from the taste buds of rats, normal rats give the same sensory nerve response to weak concentrations of salt on the tongue as salt-hungry rats give.² The salt-hungry rats prefer salty water after they have tasted it, but apparently they cannot taste it any better than normal rats.

Most of the sensations from eating are not tastes but smells. The number of smells is so great and their combinations are so complicated that no one has made much progress in classifying them. We do know that the receptors are in the mucous membrane high up in the nose. Odorous stimuli can be sniffed in through the nose or can pass up into the nose from food in the mouth. Sensory nerves run from these receptors to two small bulbs in the brain just behind the nose.

The sense of smell is astonishingly acute, perhaps 10,000 times as acute as the sense of taste. Artificial musk, for example, which is the base of many perfumes, can be detected in concentrations as low as 0.00004 milligrams per liter of air. Thresholds are raised considerably by adaptation, by heavy smoking, and by nasal congestion. Pregnancy is said to increase sensitivity to smells, but actual tests show no increase.³ Like the salt-hungry rats, pregnant women have new preferences rather than new abilities.

Some gaseous chemicals, like ammonia, irritate the lining of the nose, so the effect is not really smell but rather a tingle of pain. Soda pop, likewise, produces a tingle of pain on the tongue, which is not really taste. Most foods are quite complex and excite the touch and warmth (or cold) senses as well as taste and smell. These examples, and others to follow, show that the different senses overlap and work together, so the separation of one sense from another is sometimes an artificial separation.

The Skin Senses

There are four senses to analyze the properties of objects on the skin: warmth, cold, pressure, and pain. The pressure sense is also called touch, the adjective of which is "tactual." To locate the receptors and map their distribution, a brass rod pointed like a pencil is warmed a little above body temperature and touched to the skin of a willing subject, who is asked if it feels warm. Then the stimulus is moved a trifle and touched to the skin again. When the skin is touched at some places, the stimulus will feel warm; at other places it will not. By systematic exploration spots sensitive to warmth can be found and marked. The same procedure is followed with the rod cooled a little below body temperature, with a fine hair to test for pressure sensitivity or touch, and with a needle to test for pain. It turns out that spots sensitive to warmth and cold are sparsely distributed, but touch and pain spots are scattered rather widely over the body. We all know that pain originates inside the body as well.

Since the skin serves as a protective covering for the body, one important function of the skin senses is to locate an object of any kind that happens to come into contact with the body. If you touch a blindfolded person on the cheek with a pencil, and ask him to touch the same spot with his pencil,

the average error will be only a few millimeters. On the upper arm or thigh the average error will be a few centimeters. (If you make the test with two pens, you can easily measure the distance between the two ink spots.) If the object is vibrating, as when you put your hand on a machine to see if it is running, pressure waves travel over the skin, like waves on a pond, but even this complex stimulus pattern can be analyzed if it is not too fast, so that the location and rate of vibration are discriminated with some success.

Kinesthesia

One important sense often overlooked is the sense of position and movement of the movable parts of the body. When an arm muscle contracts and extends the arm, for example, pressure is applied to receptors buried in the tendon where the muscle is attached to the bone. This movement stretches the muscle on the opposite side of the arm and stimulates the kinesthetic receptors in this muscle also. Signals from these receptors are transmitted along sensory nerves and collected in the cerebellum. Thus kinesthesia tells us the position of the arms and legs and, when a movement is made, this sensory feedback tells us the results of the movement. At any moment we have a background of kinesthetic information within which new stimuli from any sense organ are perceived, and thus responses to the new stimuli are integrated with responses already made and in progress.

Without this sense we would have a hard time touching our fingers behind our backs or performing rapid skilled movements. We learn skilled movements, as in playing the piano and dancing, by visual guidance at first, but later we can carry on with our eyes shut because the kinesthetic feedback tells us where our hands and feet are. This is the sense we use when we heft a book to judge its weight, and this is the sense that tells us when our muscles are too tense and we ought to relax. Just as the skin senses locate objects that touch the body, kinesthesia locates objects within reach. If you walk up to a wall with your eyes closed and your hands in front of you, you can estimate your distance from the wall when you first touch it. This sense is not acute, and accuracy is low, but if you are dancing in the dark, kinesthesia enables you to make a rough estimate of your partner's waist measurement.

Organic Senses

We get vague sensations from inside the body; sensations of hunger, of stomachache, of nausea, of emotional upset, and sensations accompanying

sexual excitement. The receptors that are stimulated by these bodily conditions have not been clearly identified.

Vestibular Sense

Many senses cooperate to help us stand upright, ride a bicycle, and perceive whether an elevator is carrying us up or down. Vision is the most precise of these because the eye can detect very small deviations in the relation of the head to environmental objects. Any airplane pilot appreciates the utility of his eyes as a balancing organ when he runs into fog. But even with eyes closed, we can detect movement and rotation if they are rapid enough. Organic senses probably help because the soft parts of the abdomen swish around when the movements are sudden. But the specialized organ of

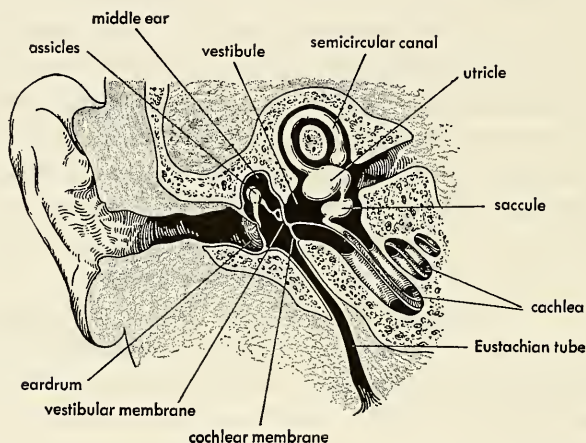


Fig. 4.3. Diagram of the human ear. (From C. W. Young & G. L. Stebbins, *The human organism and the world of life*, Harper, 1951)

balance is the vestibular apparatus in each ear. Fig. 4.3 shows the most important part, the semicircular canals.

These canals are solidly fixed in bone close to the organ of hearing, but they have practically nothing to do with hearing. They are filled with fluid, and at the base of each is a sticky bunch of hair cells that extend out into the fluid. When the head turns, the fluid lags behind and bends the hair cells in the opposite direction. These hair cells are the receptors that give the signals that run along the sensory nerves to the brain. Since there are three canals, set at right angles to each other, rotation in any plane can be analyzed with fair accuracy. Another chamber below the canals has masses of cells with calcium stones embedded in them that probably are sensitive to change in movement in any direction if the change is rapid. This sense

does not yield any sensations that we are conscious of, but it delivers signals that we use constantly in maintaining posture.

Note the similarities and differences in the functions of these various senses. Smell and taste, as well as hearing and vision, supply information about events outside the body, though the actual stimulus must impinge on a receptor in the body. Kinesthesia yields information about objects within reach. The skin senses tell us about objects that touch the body, and organic senses tell us about events inside the body. The sense of balance is different yet. It supplies information about movements of the head and position of the head in relation to the earth's gravitational field. All this information is collected in the brain and thus furnishes a background into which incoming information is integrated and from which movements are launched.

PRACTICE PROBLEMS

30. If you pinch your nostrils together while you eat a piece of apple, it does not have the usual apple flavor. What does this prove?
 - a. The nose contributes to taste.
 - b. Taste is inhibited by pressure.
 - c. Apples have no taste.
 - d. Smell is different from taste.
31. Is it true that primitive savages have keener smell than civilized people?
32. A space traveler will feel strange when he goes outside the influence of the earth's gravitational field. Name four senses that will be influenced by this "weightlessness."
33. If you rest a weight of 1 gram on a square millimeter of someone's fingertip, he will not detect it. You reach the threshold at 3 or 4 grams. If you add 300 grams more, what threshold do you reach?
34. If the tactual threshold on the fingertip is 3 grams, would you expect the tactual threshold on the calf of the leg to be 1 gram or 16 grams?
35. If you hold your left hand in cold water and your right hand in warm water for 10 minutes, an object of a certain temperature will feel warm to the left hand and cold to the right hand. Why? (a) Change of cold spots; (b) change of warm spots; (c) sensory adaptation; (d) Weber's Law.
36. In experiments like the above psychologists often speak of "physiological zero." Guess what this term means.
 - a. Absolute threshold for temperature perception.
 - b. Temperature to which skin is adapted.
 - c. Difference threshold for temperature perception.
 - d. Contrast between water and air.

Hearing

The most precise information that we get about events taking place at a distance comes through the ears and the eyes. The stimulus objects in the

environment may be trees, houses, people, electric lights, trombones, automobiles, or anything, but the stimuli that impinge on the sense organs are in the form of regular but very rapid waves of energy. Sound waves, started by some disturbance of the air, spread in all directions, like ripples on the surface of a pond, at about a thousand feet per second.

The Sense Organ. The receptors that are sensitive to such vibrations are inside the complex sense organ shown in Fig. 4.3. The sound waves funnel into the ear canal and set the eardrum in vibration. Small bones attached to the drum vibrate accordingly, and these in turn transmit vibratory pressure changes that travel through the fluid in the cochlea. The *cochlea*, a curled-up bony structure that looks like a snailshell in Fig. 4.3, contains a curled-up membrane with tiny nerve cells spaced along it which analyze the pattern of the traveling pressure waves somewhat as the skin receptors analyze the pattern of vibrations traveling along the skin.⁴ These nerve cells communicate with the large auditory nerve that conducts nerve signals to the auditory areas of the brain on each side of the head above the ear. The nerve cells are the specialized receptors; the other parts of the ear serve to transmit the sound to the receptors and to nourish and protect the delicate structures.

Stimulus Variables and Response Variables. If the stimulus that starts all this activity is an irregular mixture of sound waves, it is called noise. Scientific analysis of hearing uses simpler sound stimuli, accurately measured and controlled. The sound stimuli are named according to the *frequency* of the pressure wave or vibration in the air, middle C on the piano having a frequency of 256 cycles per second. The frequencies audible to the human ear under the best conditions extend from about 20 per second to 20,000 per second, a range of 9 octaves. Remembering the speed of sound, it is apparent that if only 20 of these sound waves reach the ear in a second, they must be pretty far apart. In other terms, the low-frequency sounds have long wavelengths; when the peak pressure of one wave hits the ear, the peak of the next wave may be 25 meters away. The high-frequency sounds that hit the ear 20,000 times a second are packed in close; wavelengths are around 0.3 millimeters. The sound stimuli are described also in terms of the intensity or amplitude of the changes in the pressure wave. The pressure is measured in pounds per square foot or, more commonly, dynes per square centimeter. In the modern psychological laboratory electronic apparatus delivers pure stimuli precisely measured in terms of these two physical variables: frequency and pressure change.

The human ear is sensitive to a remarkably wide range of stimulus intensities, extending from the threshold of around 0.0002 dynes per square centimeter to the noise level of a quiet office, which is around a thousand dynes, to thunder, which would be measured in billions. This scale is unwieldy, so

it is customary to express one intensity as a multiple of another. Taking a sound pressure of 0.0002 dynes per square centimeter as a starting place, a pressure 10 times as great is called one bel. Ten times that or a hundred times the threshold is called two bels. Ten times that or a thousand times the threshold is called three bels. And so on. The range from threshold intensity to thunder covers about 14 bels, but a more convenient unit is one-tenth of a bel, the *decibel*. Fig. 4.4 shows the whole range scaled in decibels, with some familiar sound stimuli.⁵ The decibel scale spreads out the low intensities and squeezes the high intensities, so it is convenient for calculations and for graphs. The vertical scales of Figs. 4.5 and 4.6 are in decibels.

The response variables, that is, the effects of these stimuli on the person, are harder to measure. To measure the absolute threshold we deliver a sound of known frequency—say, 2000 cycles per second—at low intensities and ask the listener if he hears it. The average young subject with healthy ears can respond correctly to sound pressures of about 0.0002 dynes per square centimeter at the ear. That is why the decibel scale of Fig. 4.5 begins at 0.0002 dynes. This pressure is so minute that it moves the eardrum only about a billionth of an inch.⁶ It is in this middle range of frequencies, between 500 and 5000 cycles per second, that the ear is most sensitive; thresholds for sounds of lower and higher frequencies are greater^{7,8} (see the bottom curve of Fig. 4.5). Some people can hear frequencies as low as 20 per second and as high as 20,000 per second, but only if they hit the ear with great force.

When sound stimuli hit the ear at a pressure of 140 decibels or so, the response is usually one of pain.

Difference thresholds, like absolute thresholds, depend on the frequency of the sound, the sharpest discrimination being in the middle range of frequencies, where most speech and music is heard. For example, if we start with a standard tone having a frequency of 1000 cycles per second at an intensity of 30 decibels, an increase of about 1 decibel makes a difference that reaches the difference threshold. That is a percentage increase of about 13 percent.

Now suppose we make a sound well above threshold intensity, perhaps 40 decibels, and simply ask someone how loud it sounds. Most people will

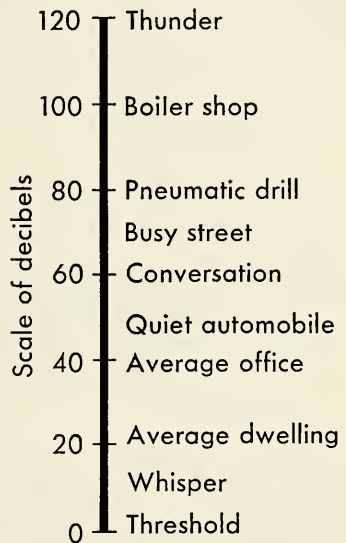


Fig. 4.4. Intensities of some familiar sounds in decibels, referred to a threshold of 0.0002 dyne per square centimeter. (After Stevens & Davis⁵)

know what we mean by loudness because loudness is a prominent characteristic of the sounds we hear. There are no physical instruments to measure the *loudness* of a sound because loudness is a psychological variable. We

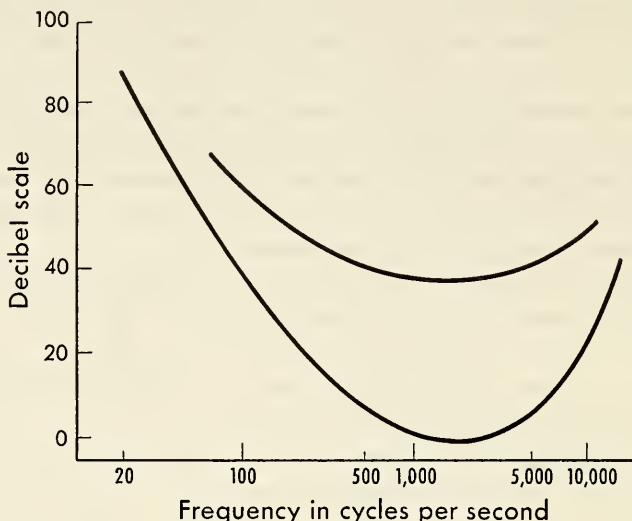


Fig. 4.5. Auditory thresholds and loudness in relation to frequency. The lower curve shows absolute thresholds at various frequencies. The upper curve is an equal-loudness contour, showing stimulus intensities at various frequencies that are judged as loud as a 40-decibel stimulus at 1000 cycles per second. (After Licklider,⁷ and Fletcher & Munson⁸)

can ask our listener to rate the sound on a scale such as very weak, weak, loud, and very loud. Musicians use the scale ppp, pp, p, f, ff, fff. Or we can ask him to turn up the volume control of a sound source until one stimulus sounds just twice as loud as another, or half as loud. Or we can tell him to

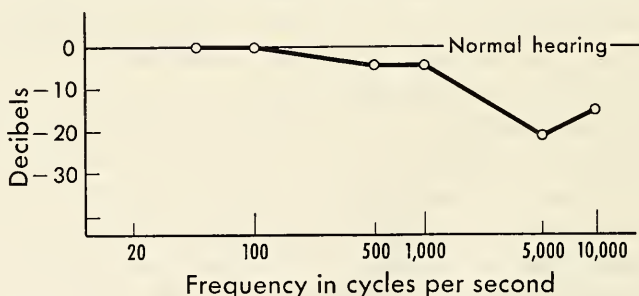


Fig. 4.6. Audiogram showing hearing loss at six frequencies. This is a case of high-frequency deafness.

call the standard sound 100 and estimate the loudness of the other sounds as 90, 240, 50, and so on, in reference to the standard.⁹ Whatever method is used, it always turns out that the loudness of the auditory sensation increases

as the intensity of the sound stimulus increases. The psychological variable, loudness, is closely dependent on the physical variable, intensity. (Unfortunately the word "sound" is used both for the physical stimulus and for the psychological response, so we often have to specify whether we mean the sound wave or the sensation of sound.)

Loudness depends on frequency as well as intensity. As one would expect from the facts about thresholds noted above, stimuli in the middle range of frequencies sound louder than stimuli of the same intensity at either the high or the low end. If you give someone a 1000-cycle tone of 40 decibels, he may say it is moderately loud. Now give him a tone of 10,000 cycles and ask him to adjust the volume control so that this tone is exactly as loud as the 1000-cycle tone. He will adjust it to about 50 decibels. Give him a tone of 100 cycles and he will adjust the volume control to 60 decibels. The upper curve of Fig. 4.5 shows the intensities necessary to make tones of various frequencies sound as loud as a 1000-cycle tone of 40 decibels.

Another prominent characteristic of the sounds we hear is *pitch*. This is a psychological variable that depends mostly on a stimulus variable, frequency. The audible frequencies cover a wide range, from 20 to 20,000 cycles per second, so this range is usually graphed on a ratio scale (see the baselines of Figs. 4.5 and 4.6). The octave as used in music is a scale of ratios between frequencies. When frequencies are expressed as ratios, increases in frequency are paralleled roughly by increases in estimates of pitch.

The human ear can discriminate one frequency from another quite well. Difference thresholds are low. For example, in the middle range of frequencies, if one tone differs from another in frequency by only 1 percent, most people will hear a difference in pitch.

Complex Sounds. Musical instruments do not send out waves of just one frequency but several. When a violinist plays middle C, the string vibrates about 256 times a second and sends out a sound wave of that frequency. But it also vibrates in halves, and each half, vibrating twice as fast, sends out a wave of 512 cycles per second, which is called an *overtone*. All musical instruments produce several overtones, as well as the fundamental tone, and it is these overtones that give each instrument its characteristic quality or *timbre*. This is the reason why middle C on the piano can be distinguished from middle C on the violin even though the intensity and the frequency of the fundamental tones are the same. A large part of the difference between the novice and the expert lies in bowing the strings so as to produce pleasing overtones, and a large part of the difference between a good violin or piano or horn and a poor one lies in a design that resonates the pleasing overtones.

Hearing Loss. Estimates of hearing loss are made with an *audiometer*, an

instrument that delivers sounds of variable intensities at a few selected frequencies, such as 100, 500, 1000, 5000, and 10,000 cycles per second, so that absolute thresholds can be measured. Audiometers are usually calibrated so that normal thresholds at each frequency get a score of zero and an increase of 10 decibels in a threshold is recorded as a 10-decibel hearing loss. A chart or *audiogram* is usually prepared, with normal hearing at each frequency appearing as a straight line and hearing losses graphed below this line (see Fig. 4.6). Hearing losses for frequencies above 4000 cycles are the usual thing in older people, especially males.

PRACTICE PROBLEMS

37. Rearrange these terms to show the course of events when a sound stimulus hits the ear: ear bones, eardrum, hair cells, cochlear fluid.
38. Frequency is to pitch as sugar concentration is to _____.
39. Sound is to decibel as temperature is to _____.
40. Intensity is to loudness as rotation is to _____.
41. What does the listener hear when a phonograph record recorded at $33\frac{1}{3}$ revolutions per minute is played at 45?
 - a. The pitch of the voices is unusually high.
 - b. The loudness of the voices is unusually high.
 - c. The loudness of the voices is unusually low.
 - d. The bass notes are below the threshold.
42. Someone claims that Weber's Law applies to auditory intensities and someone claims that it does not. What would you do to get an answer to this question?
 - a. Compare frequencies while holding intensity constant.
 - b. Compute percentage of errors in identification of a range of musical notes.
 - c. Ask people to rate the loudness of sounds at 20, 40, and 60 decibels.
 - d. Compare difference thresholds at 20, 40, and 60 decibels.

In experiments on hearing which of these are independent variables and which are dependent variables? Label each Ind or Dep.

- | | |
|----------------------|---|
| 43. _____ Frequency. | 46. _____ Pitch. |
| 44. _____ Intensity. | 47. _____ Difference between two stimuli. |
| 45. _____ Loudness. | 48. _____ Errors of discrimination. |

Vision

Light is a form of energy that travels through space, celestial as well as terrestrial, at 186,000 miles per second. Light waves, like sound waves, start from an energy source and may be bent or reflected by objects in the environment before stimulating the sense organ. But when light reaches the eye, it brings information about the reflecting object—the green leaf, the white house, the shiny car—whereas sound brings information about the source—the piano, the voice, the bell.

The Sense Organ. The receptors sensitive to light are in the retina in the back of the eye. The function of the complicated sense organ is to collect and focus the light rays on this *retina* (see Fig. 4.7). Light falling on the eye passes through the protective outer layers, through a transparent fluid, and through the pupil. The *pupil* is the dark hole you see when you look someone right in the eye. It is dark because there is no light behind it—just as a keyhole is dark when the room behind it is not lighted. Surrounding this is

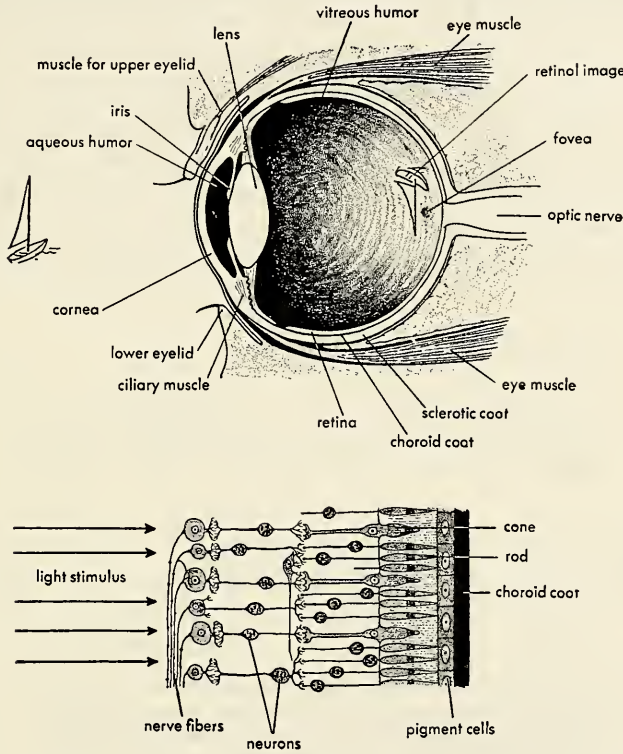


Fig. 4.7. (Above) Cross section through the human eye, showing location of inverted image on retina. (Below) Greatly enlarged cross section of retina, showing rods and cones and connections with nerve fibers. (From C. W. Young & G. L. Stebbins, *The human organism and the world of life*, Harper, 1951)

the *iris*, which gives the eye its color and the poet his inspiration. The iris has muscles that make the hole larger or smaller in response to the amount of light reaching the retina. This response is known as the *pupillary reflex*.

Having passed through the pupil the light passes next through the lens, then through a transparent fluid to the retina. The *lens* is a transparent capsule containing a transparent fluid. When the tiny ligaments that hold the lens in place are tight, the lens is stretched and flattened, and this flat lens brings light from a distant object into focus on the retina. When one looks

for example, absorb nearly all the short wavelengths and nearly all the long wavelengths, reflecting to the eye only those in the neighborhood of 550 $m\mu$. To the human eye an oak leaf looks yellowish green. Fig. 4.10 shows how the visible spectrum can be imitated by reflected light from modern printing inks. For testing vision daylight sources are inconvenient, so reflecting surfaces such as colored papers, wools, and enamels are commonly used.

Another way to manipulate the stimulus light is to put colored glass or plastic in front of it, like a theatrical spotlight or a Christmas tree light. Such a filter obstructs most of the light and permits only a narrow band of

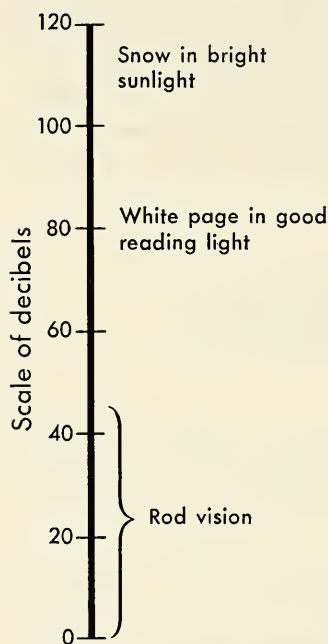


Fig. 4.11. Light intensities on a scale of decibels. (After Bartley¹¹)

wavelengths to pass through. A filter that passes only long wavelengths of 620 to 650 $m\mu$ is called a red filter and the light that shines through it reddens most objects. Naturally if a surface that reflects only short wavelengths in daylight is illuminated through a filter that cuts out the short wavelengths, it will not reflect much light of any kind to the eye.

Response Variables. The psychological response to light is called vision, and the first question is one of absolute thresholds. How much light is necessary to evoke a visual response? Methods for measuring absolute thresholds for light are about the same as methods for measuring thresholds for sound. However, when the two receptors, the cones and the rods, are stimulated separately, different thresholds are obtained. If a tiny spot of light is shown in a dark room and the observer is asked to look directly at it, the light rays fall on the fovea where only cones are stimulated.

Careful testing under these conditions yields the measurements shown in the middle curve of Fig. 4.10.

If the observer is not required to fixate the light spot so carefully, the light will fall on other parts of the retina where there are rods as well as cones. Under these conditions thresholds are lower, as shown by the lower curve of Fig. 4.10. For this reason, if you are searching for a faint star or a dimly lit object, you are most likely to see it when you have sighted to one side of it, letting the light from it hit the retina a little off center. But rod vision is not effective at the red end of the spectrum; at wavelengths beyond 650 millimicrons vision is cone vision. (The easiest way to memorize these facts is to memorize Fig. 4.10.)



Fig. 4.10A. Visual thresholds and brightness in relation to wavelength. The bottom curve shows rod thresholds and the middle curve cone thresholds at various wavelengths. Thus the stippled area has rod vision only; no colors are seen. The top curve is an equal-brightness contour, showing intensities of light at various wavelengths that are judged as bright as a 60-decibel green light of a wavelength of 550 millimicrons.

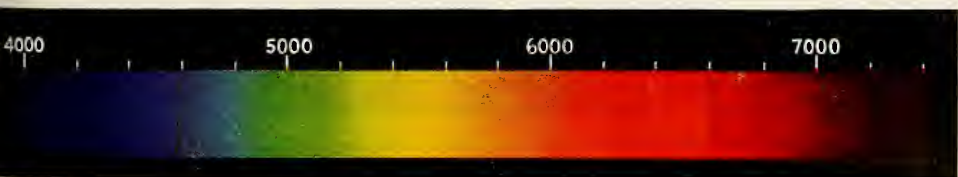


Fig. 4.10B. The visible spectrum. Sunlight is broken up by a prism so that the different wavelengths can be photographed and printed side by side to correspond with the baseline of the graph above. The units are tenths of a millimicron. (From John C. Duncan, *Astronomy*, Harper, 1955)

Above threshold intensity, a common visual task is to discriminate one light from another that differs slightly in intensity. This difference threshold is measured by comparison of two pieces of ground glass, differentially illuminated from behind, or by comparison of two surfaces reflecting different amounts of light. By either method difference thresholds are rather low, and fortunately so, because we depend on intensity differences to guide our behavior all day long. We see the corner of a building where two surfaces come together, for example, because the surfaces reflect different amounts of light. A shadow is a difference in amount of light reflected from one surface and amount reflected from an adjacent surface, and shadows give us considerable information about objects around us. One who cannot make fine intensity discriminations cannot use the information that comes from faint shadows.

Now suppose we ask someone to look at a light source or a lighted surface and ask him how bright it is. *Brightness* is a psychological variable that depends in part on the physical energy or intensity of the light. Move the light closer and more radiant energy hits the eye; the light appears brighter. Brightness does not depend on intensity alone, however. Lights in the middle range of wavelengths look brighter than lights at either end of the spectrum. The upper curve of Fig. 4.10 shows the intensities necessary to make lights of various wavelengths appear equally bright. (The other important factor influencing the brightness of a light is adaptation, which will be considered later.)

Another prominent dimension of the visual response, after brightness, is *color*. The color of a light depends on its wavelength composition, as shown in Fig. 4.10. Only the cones can discriminate wavelengths, so colors will not be seen unless the light intensities are above the thresholds for cone vision shown in Fig. 4.10. At low intensities of illumination, as at twilight and dawn, brightness differences appear but no color differences. Fortunately, when the illumination is good, the normal human eye can discriminate wavelengths that differ by only 3 or 4 millimicrons in the middle range between 410 and 620 $m\mu$.¹² Since the range of usable wavelengths is more than 200 $m\mu$, this capacity for fine color discrimination means that we can make a large number of differentiations on this basis alone—at least under ideal conditions. For practical purposes, however, as when colors are used to label containers or to identify switches, only 15 or so can be identified with 95 percent accuracy.¹³

The third prominent dimension of vision, after brightness and color, is *saturation*, which depends on the purity of the light. If the light has a wavelength of 680 millimicrons, not contaminated by other wavelengths, it will appear as a clear saturated red. If it is mixed with white light, which contains many wavelengths, it will be less saturated and will appear pink. A pure red, or pure blue, or pure green light is 100 percent saturated. Reflect-

ing surfaces coated with modern dyes, inks, or enamels may be highly saturated also, but mixing colors always desaturates them.

When yellow and blue spotlights overlap on a screen, the mixture, if the proportions are correct, will appear as white light. Pairs of colors that desaturate or neutralize each other in this way are called *complementary colors*. A yellow light of 585 $m\mu$ and a blue light of 485 $m\mu$ are complementary in this sense, and so are a red of 660 and a blue-green of 497. When reflecting surfaces, such as stop signs, are painted in two complementary colors, good contrast is obtained.

Visual Acuity. Visually, the world around us consists of patterns of light, and the eye's job is to register these patterns on the retina somehow, and then send information about them along the optic nerve to the brain. The best eye for this purpose would be one that can discriminate fine details,

but we would not want one that sees so many details it misses the larger outlines of objects. Actually the eye in operation is an efficient compromise between detail vision and overall vision. An extremely small gap in a line is not detected, so we see a continuous line. But if the gap is large, we detect it. The ability to detect such small gaps is called *visual acuity*. It might be



Fig. 4.12. Two types of pattern for measuring visual acuity.

called the threshold for pattern vision. Gaps smaller than the threshold are overlooked; larger gaps are seen.

Two simple patterns for measuring visual acuity are shown in Fig. 4.12. The gaps or interruptions in the broken circles may be white on black or black on white. The smallest gap that can be detected depends on distance from the eye, as you can prove by having someone look for the gaps at various distances. Therefore the measure of acuity must include distance. A measure that combines the size of the gap and the distance is the *visual angle*. Fig. 4.13 shows three gaps at various distances, all of which are measured by a visual angle of one degree at the eye. The threshold or visual acuity of the normal eye under good conditions is about $\frac{1}{60}$ of a degree, or one minute.

When you have your eyes tested by an optometrist or ophthalmologist, a less precise but more convenient method is used. A line of letters is printed on a chart so that the gap between the segments of the letters, e.g., between

the horizontal bars of the **E**, subtends an angle of one minute at 20 feet. Larger and smaller gaps are on other lines. If you can see at 20 feet what is normal for 20 feet, that is, a gap of one minute, you are said to have 20/20 vision. If you can see only the larger letters that subtend an angle of two minutes, which the normal eye sees at 40 feet, you are said to have 20/40 vision.

How can the eye perform this remarkable achievement? Remember that the retina is a mosaic of rods and cones packed close together, as many as 200,000 in a square millimeter, and that in the center of the eye each cone has its own nerve. Under the best conditions a gap in a pattern of light means that a few cones are stimulated more intensely, or less, than the neighboring cones, so the corresponding nerves carry signals that are stronger, or weaker, than neighboring nerves.

Visual acuity is best, of course, under strong illumination, without glare. Basically a gap is seen only if the difference in light intensity between the gap and the rest of the pattern is above the difference threshold for intensity. If the gap is a light gray and the surrounding pattern is a medium gray, visual discrimination is very poor. In other words, good vision for details requires good contrast between the details and the surrounds. A yellow-on-blue sign is visible at lower illumination or greater distance than a green-on-blue sign.

Adaptation. The range of illuminations to which the eye can adapt is quite extensive. We can see details in bright daylight, then walk into a dimly lit basement and, after a few minutes, see details there also. The pupil assists adaptation to the dark by widening and admitting more light. When wide open the pupil admits about 15 times as much light as when it is constricted. But the range of lights that we adapt to is far greater than this; much more adaptation takes place in the retina. In fact electrodes attached to the optic nerve behind the retina show that the neural response to a light flash of standard intensity is much greater after the eye has been in the dark for 20 minutes than it is at first.¹⁴ Fig. 4.14 shows how the absolute threshold of a human observer decreases, or sensitivity increases, during a half-hour in the dark.¹⁵ When measurements of visual acuity are made intermittently in the dark, the same kind of graph is obtained. Details gradually appear and in 15 or 20 minutes there is a big improvement. When one moves from a dark room into bright light, the reverse process of light adaptation is much faster, requiring only about a minute.



Fig. 4.13. Three gaps, each of a visual angle of one degree at the eye.

Adaptation to the dark is a remarkable accomplishment, but it takes time. A navigator looking back and forth from his illuminated charts to the stars can waste considerable time waiting for his eyes to adapt. During World War II a psychologist solved this problem by recommending the use of red goggles while reading charts.¹⁶ The light transmitted through the red glass stimulates the cones and permits reading moderately well but does not stimulate the rods. The rods maintain their dark adaptation and are ready to work in dim light.

Eye Movements. The eye is a pretty busy organ. We are apt to think of it as a passive instrument, like the film of a camera waiting for light to reach it. It is better, however, to compare the eye to a catcher on a baseball team. It is waiting to receive what is coming, but it is waiting actively, and it ad-

justs automatically to what has already arrived.

The adjustments of the pupillary reflex, and the adjustments of the lens, called accommodation, were mentioned earlier. Since we have two eyes and they must work together for clear vision, there is another set of muscles responsible for *convergence*. Both eyeballs turn in slightly to see an object close to the nose and straighten out for objects farther away. The eyes, as a pair, also move from side to side and up and down so that, without

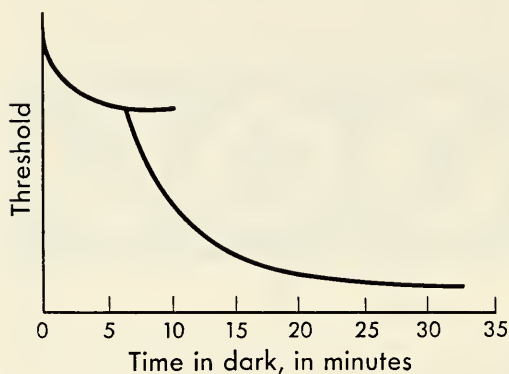


Fig. 4.14. Dark adaptation. The upper branch of the curve represents adaptation of the cones, and this is the limit when only the fovea is stimulated. If the light stimulates the rods, thresholds are lower and adaptation continues longer, as shown in the lower branch. (After Hecht¹⁵)

moving the head, one can see about 180 degrees in the horizontal dimension and a little less than that in the vertical dimension. The side-to-side movement is crucial to reading, and fortunately, as we shall see in the next chapter, most eyes can jump along a line of print quite rapidly. These eye movements are coordinated also with hand movements, head movements, and walking movements.

Sensory Functions of the Brain

The receptors in the sense organs start nervous signals along the sensory nerves to the central nervous system, that is, to the spinal cord and brain. Then what happens? In the case of a simple reflex, like withdrawal of the leg from a hot stimulus, the sensory nerve may communicate with a connecting nerve in the cord that communicates directly with a motor nerve going

to a muscle. If the background of previous stimulation and feedback permits, the muscle will contract. Nervous signals go up the cord to the brain also, but perhaps not until the muscle has responded.

Sensory nerves from many receptors feed into the brain, where the neural activities are much more complicated. Our knowledge of the functions of the various areas of the brain comes partly from observing the consequences of accidental damage to the brain and partly from direct electrical stimulation when the skull is opened for surgery. Inferences about the human brain can be made from experimental removal of parts of the brains of monkeys and apes, which are quite similar to man's brain. From these kinds of evidence some of the sensory areas of the brain can be mapped as shown in Fig. 4.15. There are many complex interconnections between the different parts of the brain, some of which have not yet been disentangled, but we know that information reaching the sensory areas is integrated in some manner, and then neural discharges in the motor area send neural signals down the cord to the muscle groups.

The cerebellum has a special function in connection with balance and coordinated movements. In-

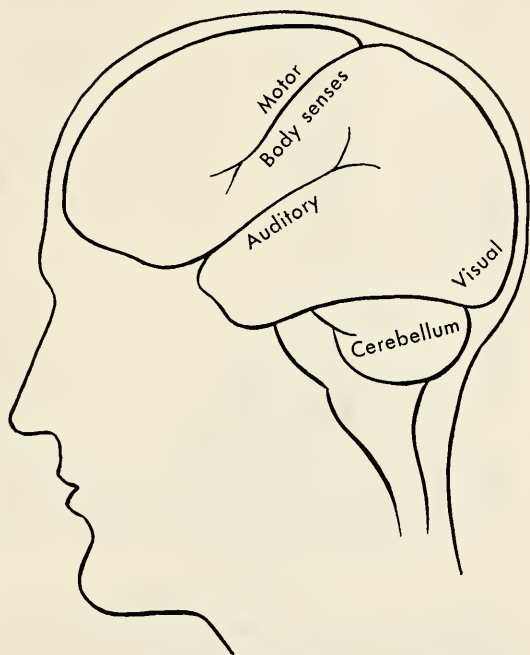


Fig. 4.15. Brain in skull, showing cerebellum and some sensory and motor areas of the cortex.

formation from the kinesthetic receptors, the semicircular canals, the eyes, and other receptors is collected in the cerebellum as well as in the cerebral cortex. Kinesthetic information about movements in progress, for example, feeds back into the cerebellum and is used to control the rate and direction of movements initiated by the motor cortex, and to correct errors. Damage to the cerebellum results in unsteadiness and inaccuracy of movement.

Individual Differences

All human beings are built on the same plan and, aside from accidents and disease, most people have about the same sensory equipment. Individual

differences in sensory abilities are smaller than individual differences in achievement motivation or aesthetic value. The chief reason is that the sensory apparatus, being mainly hereditary, is not modified by experience to any great extent. People may differ slightly, however, in any of the sensory functions described in this chapter.

A few years ago a chemist noticed that he could not taste a certain chemical which his co-workers said was very bitter. Geneticists soon became interested in this curious substance, called phenylthiourea, and prepared it in various concentrations to test for individual differences. Fig. 4.16 shows the

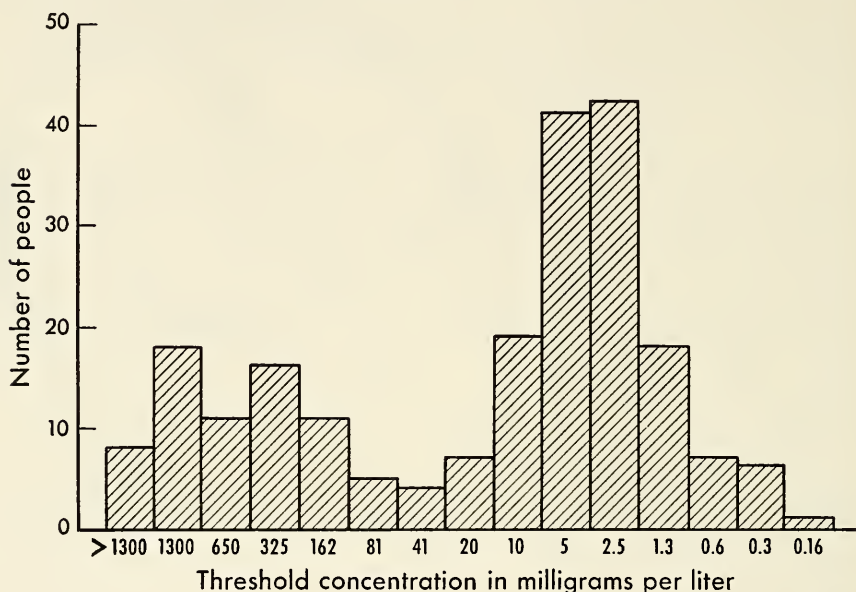


Fig. 4.16. Individual differences in a special gustatory ability. When solutions of a bitter chemical, phenylthiourea, were sipped by 214 people, the results divided the people into two types: about a third who could taste it only at concentrations above 60 mgm. per liter, and two-thirds who could taste it in dilute solutions. There are the usual variations within each group but the division between them is clear cut. (Data from Harris & Kalmus¹⁷)

taste thresholds for 100 women and 114 men, from which it is clear that there are two types of people in respect to this ability.¹⁷ When the solution is prepared in medium strength, about 60 mgm. per liter, the non-tasters are separated from the tasters, and genetic investigations have demonstrated a simple mode of gene transmission.

Individual differences in hearing ability are due to heredity, age, accidents, and disease. Acuity develops rapidly in growing children, reaching the maximum between 13 and 15 years of age. The hearing of normal adult men and women, as tested by telephone engineers,¹⁸ is shown in Fig. 4.17. A few have very keen ears, a few very poor, but most people are near the

average. This sort of distribution of ability occurs when the ability results from many independent factors, such as age, heredity, childhood illness, and so forth. Contrast Fig. 4.17 with Fig. 4.16, which shows two distinct types of taste, produced by a few simple hereditary units.

To measure hearing thresholds accurately, precise apparatus is necessary. Measurements of hearing loss, useful for the fitting of a hearing aid, can be made tolerably well with portable office audiometers. Rough measures of sensitivity, useful for routine measurement of individual differences, can be obtained with the aid of phonograph records, such as the Seashore Measures of Musical Talent. These yield scores for frequency discrimination, intensity discrimination, musical memory, and other such abilities.

After 30 the aging of the sense organs and the nervous system produces a decline in hearing ability, especially at frequencies above 1000 cycles per second (see Fig. 4.6). The decline with age in high-frequency sensitivity is more severe in men than in women.¹⁹ Infections and accidents may lead to partial or total deafness for all or most frequencies, but occasionally people exposed to very intense sounds, such as heavy gunfire, become deaf to only a limited range of frequencies.

Individual differences in vision, as in hearing, are due chiefly to heredity, age, accidents, and disease. Visual functions develop rapidly in growing children, reaching maturity around age 10, and decline slowly as the eye grows old. The most common defect is in the shape of the eyeball. The near-sighted eye is too long and does not focus a distant object sharply on the retina, so visual acuity is poor. The farsighted eye is too short and does not focus a near object sharply. Fortunately most of these defects can be corrected fairly well by glass or plastic lenses in front of the eyes, and about 30 percent of adults wear such glasses. The aging process has its principal

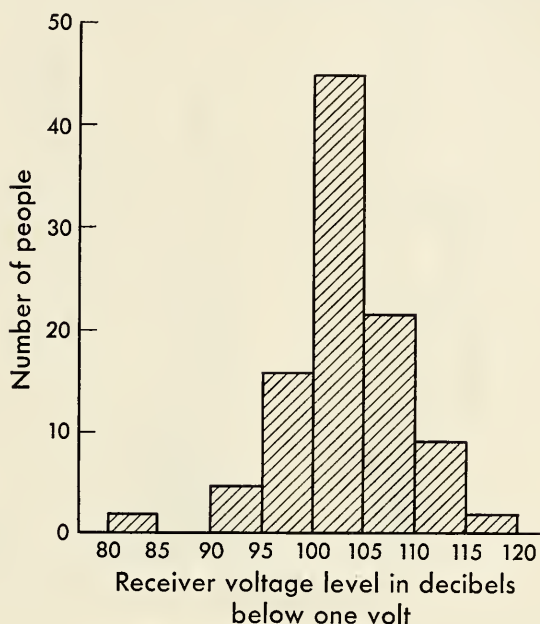


Fig. 4.17. Individual differences in the hearing ability of 100 people. Receiver voltage level is one way of expressing the absolute threshold. There is no evidence here, as in Fig. 4.16, for two types of people. (Data from Steinberg & Munson¹⁸)

influence on the *near point*. The normal 12-year-old can hold a book as close as five or six inches from his eyes and read it fairly well. After 20 the near point starts to retreat, and the average adult of 40 without glasses has to hold his book 12 to 14 inches away. Like the joints, the lenses get stiff. Aside from these defects the distribution of visual abilities is much like the distribution of other abilities²⁰ (see Fig. 4.18). A few people are very good. A few are very poor. Most people are in the middle.

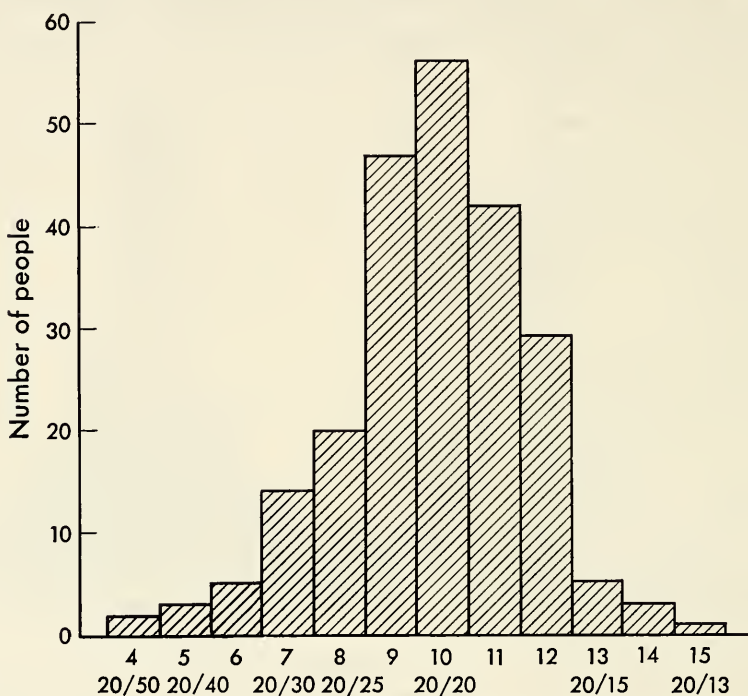


Fig. 4.18. Individual differences in visual acuity. The baseline shows the familiar scale in which 20/20 is considered normal and a decimal scale, extending both ways from 10 by steps of 1, which is statistically more convenient. (From Tiffin & Wirt²⁰)

The next most common defect is poor vision for some wavelengths. About 8 percent of the male population has some color weakness, if mild cases are counted, and less than 1 percent of the female population. It is a hereditary defect. The most common form is poor sensitivity for green; next comes poor sensitivity for red. That is, these people do not see greens or reds unless the intensity is pretty high. A few men are actually blind to green and red, and a very few have no color vision at all. One whose sensitivity to green is reduced finds it hard to differentiate blue from green-blue if brightness is the same. Many people have a mild weakness of color vision and do not know it until they take a test. They may be confused by color names,

but so is everyone else. They can differentiate traffic lights fairly well because the red light has a little yellow in it and the green light has a little blue. Like the rest of us, they automatically seize any cue they can use in adjusting to their environment; hence a mild color weakness may pass unnoticed, like a mild hearing defect.

A precise test for the most common types of color weakness asks the subject to mix green and red lights to make yellow. The apparatus and filters are arranged so that normal subjects use approximately equal amounts of

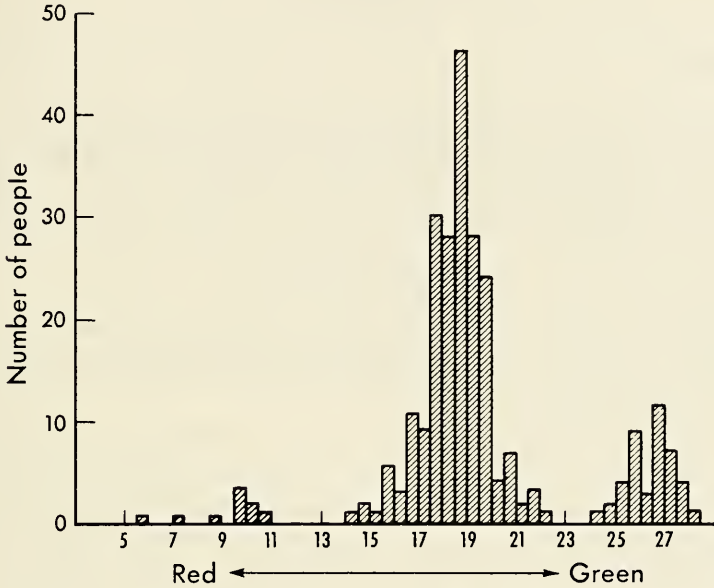


Fig. 4.19. Individual differences in color vision. This test requires the subject to mix red and green lights to match a yellow light by moving a shutter. The baseline shows the shutter settings. The large number of normal subjects in the middle of the graph use about equal amounts of red and green, though there is some variation even among those of normal vision. At the right is a group of green-weak subjects who had to use a large amount of green light to match the yellow. At the left is a small number of red-weak subjects who needed considerable red for their matches. The green-weak and the red-weak are clearly outside the normal range; hence this graph shows three types of people in respect to color vision. (Data from Pickford²¹)

red and green to match the yellow. Those who have weak sensitivity for green have to add more green to match the yellow. Those who have weak vision for red have to move the shutter in the other direction and add more red. Fig. 4.19 shows the distribution of color matches by this test for 257 subjects in Scotland.²¹ Most people are near the average, but there is a distinct group who are relatively insensitive to greens and a smaller group insensitive to reds. (There were about four times as many color-weak in this sample as in the population at large.) There are many quicker tests that do

not attempt to measure weakness of color vision but merely pick out those with serious defects. These use colored ink on paper and ask the subject to discriminate a letter or number from a background that has a different color to the normal eye.

Sensory abilities are specific to the sense organ. One who has acute vision may or may not have acute hearing or acute taste. One who has weak color vision may or may not have poor visual acuity. There is no relationship between individual differences in these various sensory functions, as far as we know, so each has to be tested separately.

SUMMARY

This chapter attempts to identify the physical stimuli or stimulus dimensions to which man is sensitive, leaving relations with stimulus objects to the next chapter, "Perception." The effects of these physical stimuli can be studied by observing reflexes and by asking people to discriminate stimuli or to estimate the magnitude of their psychological effects. In all senses contrast and adaptation occur, and the differential threshold increases as the standard stimulus increases. All sense organs are similar in that they all contain specialized receptors in contact with sensory nerves that communicate with certain sensory areas of the brain.

The stimuli for taste and smell are chemical. The skin is sensitive to warm and cold stimuli, as well as to mere pressure of an object on the skin. Many injurious types of stimulation, such as extreme heat, bruising, and cutting of the skin, produce an avoidance response and a feeling of pain. The receptors for kinesthesia, which gives us information about position and movements of parts of the body, are in the muscles and tendons. Receptors in the inner ear are sensitive to movement of the body in relation to the earth's gravitational field.

Variations in the intensity of a sound are heard as variations in loudness. Loudness depends also on the frequency of the sound because the ear is most sensitive to the middle range of frequencies. Variations in frequency are heard as variations in pitch. Timbre depends mainly on the pattern of overtones.

The light stimulus that reaches the eye comes from the sun and from artificial sources like electric lights, but is usually modified by filters such as clouds or glass that stop part of the light and transmit the rest or by reflecting surfaces that absorb part of the light and reflect the rest. The sense organ, the eye, is an elaborate apparatus for focusing the light rays from luminous sources or reflecting surfaces on the rods and cones in the retina. The brightness of a light source and the lightness of a reflecting surface both depend on the amount of light that they send to the eye and also on the wave-

length because the eye is most sensitive to the middle range of wavelengths. Variations in wavelength are seen as variations in color. Pure colors, not mixed with white or any other color, are seen as saturated, and pairs of colors that desaturate or neutralize each other are known as complementary colors.

Visual acuity is measured by the smallest angular separation that can be discriminated. Defects in the eyeball reduce visual acuity because the visual image is not focused sharply on the retina, but most such defects can be corrected by glasses. The eye adapts to a great range of intensities, so that visual acuity gradually improves in the dark.

Individual differences in sensory capacities are due to heredity, age, illness, and accidents. Weaknesses in color vision are quite common among males. Some weaknesses in chemical sensitivity and color sensitivity are known to be hereditary. Increasing age produces loss in hearing for high frequencies and loss of ability to focus vision on near objects. These sensory capacities are quite specific and have to be tested separately.

PRACTICE PROBLEMS

49. Distance receptors are those that give information about objects not in contact with the body. Name three distance receptors.
50. Which of the curves in Fig. 4.20 represents the wavelength composition of daylight?
51. Which of the curves of Fig. 4.20 represents the wavelength composition of light reflected from a green leaf?
52. Of the three methods of testing sensory capacities, which can be used only with human subjects?
53. Comparing Fig. 4.5 and Fig. 4.10 what generalization can you make?
 - a. Receptors are most responsive in the middle of the range of stimuli to which they are sensitive.
 - b. Under threshold intensities vision yields more information about radiant energies in the environment than hearing.
 - c. The human eye and the human ear function according to the same general principles.
 - d. Cone vision follows the same principles as absolute pitch.

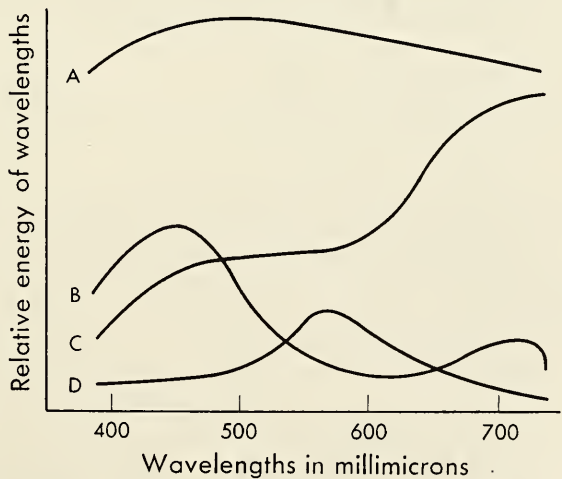


Fig. 4.20. Wavelength composition of various light sources.

In experiments on vision which of these are independent variables and which are dependent variables? Label each Ind or Dep.

54. _____ Wavelength.
55. _____ Energy.
56. _____ Brightness.
57. _____ Color.
58. The brightness of a light depends on two variables in the environment and one in the organism. Name these three variables.
59. Pitch is to frequency as color is to _____.
60. Intensity of a sound is to loudness as intensity of a light is to _____.
61. Mr. Stone is standing in a well-lighted room a foot in front of a large map of the United States. He sticks a green thumbtack in Bangor, Maine, then takes a step to the left and sticks a green thumbtack in Omaha, Nebraska. While looking at the Omaha thumbtack, he notices the Bangor thumbtack out of the corner of his eye, but it is no longer green. Why?
 - a. His eye has become adapted to green light.
 - b. Visual acuity is better in the fovea.
 - c. The periphery of the retina has very few cones.
 - d. The light from the Bangor thumbtack falls on the blind spot.
 - e. Rods are more sensitive to weak light than cones.
62. A narrow band of wavelengths has the same relation to daylight as a pure tone has to _____.
63. Red goggles to aid dark adaptation should be constructed of glass or plastic that cuts out light below what wavelength: 400, 500, 550, 600, 650, 700?
64. Which two of these senses yield good information about sequential environmental events: taste, smell, touch, hearing?
65. If the withdrawal reflex is a response to a painful stimulus, what is the stimulus for the pupillary reflex?
66. Fig. 4.14 has an important place in the theory of vision. It supplies strong evidence for which of the statements below?
 - a. Color vision depends on the cones.
 - b. Acuity depends on the size of the receptor cells in the retina.
 - c. There are two kinds of visual receptors.
 - d. Thresholds should be measured in decibels.
67. Hold your head in your hands with your elbows on the table so that your head is fixed in relation to the environment. Close one eye. Now move the other eye from side to side and estimate the horizontal visual angle for monocular vision. Which of these is the closest estimate: 85, 100, 130, or 170 degrees?
68. Lock your arms over your chair so that your shoulders are fixed in relation to the environment and turn your head and eyes as far as possible to the left and right. What is the horizontal visual angle for binocular vision with head and eye movement: 280, 300, 320, 340, or 360 degrees?
69. If you compare the brain of a dog with the brain of a man, which part of the dog's brain will be larger, in relation to the size of the whole brain, than the man's? (Consider what stimuli are important to a dog.) (a) Visual area; (b) hearing area; (c) motor area; (d) olfactory area.
70. Which part of a sparrow's brain is larger, relatively, than the same part in man's? (Consider how the sparrow adjusts to his environment.) (a) Cerebellum; (b) frontal area; (c) hearing area; (d) body sense area.

71. Many people believe that man has five senses. This statement is (a) the truth, the whole truth, and nothing but the truth; (b) false; (c) true but incomplete; (d) psychologically irrelevant.

The following is modified from a report of a new test of scotopic sensitivity, developed by J. A. S. Kinney, E. J. Sweeney, and A. P. Ryan of the U.S. Naval Medical Research Laboratory in New London, Connecticut, and published in the *American Journal of Psychology*, vol. 73, 1960, pages 461-467. The statements in parentheses are to be marked True or False, and anyone who marks them correctly has mastered some of the important concepts and principles of the psychology of vision and has acquired some skill in reading a scientific report.

A new test of sensitivity for night vision has been developed and standardized at this Laboratory and it is now available in a compact, portable model. The test is based upon sampling the subject's scotopic sensitivity at a number of retinal positions. (72. ____ The context suggests that the adjective *scotopic* refers to vision at low levels of illumination.) Previous studies have shown that the sensitivity of the eye to dim light varies throughout the retina, being poorest at the fovea, increasing to a peak at 10° to 15° from the fovea, and then decreasing gradually to the extreme periphery. (73. ____ The term *retinal position* must refer to the point on the retina that is stimulated by the light from a small external source. 74. ____ Positions on the retina are measured in terms of percentages.) In addition, sensitivity is not uniform throughout the various quadrants, the nasal field, i.e., the temporal retina, giving the most sensitive measures. (75. ____ The description suggests that the test is a binocular test.) While averaging the data for a group of S's yields the same map of retinal sensitivity, there are significant individual differences, not only in the overall levels of sensitivity, but also in the profiles obtained.

To evaluate S's sensitivity properly it is thus necessary to test at various locations and to give him a score compiled from these various measures. (76. ____ The abbreviation *S* refers to scotopic. 77. ____ The term *individual differences* refers to differences between S's.)

The test also utilizes stimuli of various sizes. Previous results have shown that small stimuli of different sizes yield the same type of data as do small stimuli of different brightnesses. Normal psychophysical functions are found when size is used as the variable; in addition, identical maps of retinal sensitivity are obtained when the stimulus variable is either size or brightness. This allows an extremely convenient measure of sensitivity, in terms of size, and also yields an internal check of the validity of S's results. (78. ____ This paragraph is concerned in general with the definition of the dependent variable.)

Various methods of administering and scoring the test also have been investigated. On the basis of these results, the present method of presenting two stimuli at a single trial and of using the total number correctly identified as the score was chosen. (79. ____ This means that on any trial S could get a score of 0, 1, or 2.)

Five sizes of stimuli are used in the test; at a viewing distance of 14.3 inches, these subtend visual angles of 0.09° , 0.124° , 0.156° , 0.186° , and 0.220° . Twelve positions in the visual field are tested; these are located at 6° , 12° , and 20° above, below, to the right, and to the left of the central fixation point. (80. ____ Visual angle is the usual measure of brightness. 81. ____ The argument for using 12 positions in the visual field was presented in the first paragraph of the report.) The entire test takes less than 15 minutes, excluding dark adaptation. (82. ____

The total time, including dark adaptation, would therefore be about 20 minutes.
83. _____ These paragraphs are probably followed by a report of the results obtained from the use of the test.)

Discussion Questions

- A. If you could have another eye, where would you like to have it?
- B. Why is the nose on the face?
- C. Do you see any significance for social interaction in the fact that the ear is most sensitive to sounds within the range of human speech?
- D. What technical psychological terms are included under the popular term "feel"?

Recommended Reading

- W. A. van Bergelijk, J. R. Pierce, & E. E. David, Jr. *Waves and the ear*. Doubleday, 1960. A short paperback book by scientists of the Bell Telephone Laboratories about the physics, physiology, and psychology of hearing in man and other animals.
- F. A. Geldard. *The human senses*. Wiley, 1953. A general treatment of facts and theories about all known senses.
- R. M. Evans. *Eye, film, and camera in color photography*. Wiley, 1959. Physical and psychological principles applied to the problems of the photographer.



Photograph by Julius Shulman, in Treasury of American Gardens, Harper, 1956

Chapter 5. PERCEPTION

If you ask a friend to put his head out the window and describe what he sees, he will report, not sound waves and light waves, but objects in space. He will mention things like a red-brick building at the left, two automobiles on the road to the right, a man and a woman walking on the grass, and white clouds against a blue-gray sky. Although the sense organs are bombarded by several kinds of stimuli, from several directions, it all appears to be one scene. The ground may be dark green in the shadows and light green in sunlight and it may be partially hidden by trees and buildings but it is perceived as a continuous surface extending from left to right and from foreground to background. Buildings and moving objects are located left and right, near and far, on this horizontal plane. In general we can say that the individual organizes the information that the physical stimuli bring to his sense organs and constructs a reasonably consistent and continuous perception of the world around him. The present chapter describes the principles by which this organization is achieved, then applies these principles to several common perceptual tasks: perceiving objects in space, reading, and listening.

We cannot directly observe the perceptions of our friend as he looks out the window. All we can observe is what he does, including what he says. From observation of his behavior, including verbal behavior, we make inferences about his perception. If he looks to the left when his name is called, we may infer that he perceived the sound as coming from the left. If he walks confidently on light grass and dark grass, we may infer that he perceives the grass as a continuous horizontal plane in spite of variations in brightness. His behavior is a response, not necessarily to the physical world, but to the world that he perceives; hence we can work backward and infer perception from behavior. If he describes what he perceives, his comments also aid the inference about his perception. Then, if we are serious, we check these inferences against later behavior, just as we check our inferences

about motivation. There is a little difference, however. My inference about my friend's perception when he looks out the window is assisted by my perception when I look out the same window. It is a fair hypothesis, under most conditions, that he perceives approximately what I perceive. But it is only a hypothesis, to be checked by more sophisticated methods.

The methods for investigating perception are like those described in the preceding chapter for investigating sensory functions except that the conditions are less restricted, more natural. When we measure an individual's threshold for light, for example, we are interested in the physical stimulus, so we use a small light source in an otherwise uninteresting room and ask him to get set for this simple stimulus and make a simple judgment of Yes or No. The subject's set is standardized and some simple stimulus dimension is manipulated so that the subject's successes and errors can be directly related to variations in the physical stimulus. But perception, we know, refers to environmental objects rather than physical stimuli, so we manipulate many environmental conditions in order to find out what the individual does with the information delivered by the sense organs. We use more complex stimuli and put these in various natural and artificial surroundings. Instead of standardizing the individual's set, we manipulate incentives, instructions, opportunities for practice, and other variables to see how all these independent variables influence the individual's organization of sensory information. And we may ask the individual for a more complicated response than Yes or No; we may ask him to locate, identify, and describe the stimulus

objects. Our skeleton formula is still $S \begin{array}{c} \searrow \\ \nearrow \end{array} O \rightarrow R$, but the R is a response from which perception can be inferred.

PRINCIPLES OF PERCEPTUAL ORGANIZATION

Perception is a complex process. We will begin with perception of simple artificial things that are easily analyzed and work out some general principles. The principles are the same for all senses, but visual perception is the easiest to illustrate on the printed page. Later in this chapter we will examine some practical perceptual problems of real life and see how the principles help to explain what happens. Following the general scheme of this book we will begin with factors in the stimulus situation, the S factors, then factors in the individual, the O factors.

Stimulus Factors

The most primitive kind of perceptual organization is the *figure-ground* pattern, as in A of Fig. 5.1. The black is easily differentiated from the white surrounding it because the brightness difference is well above the differential threshold. But the black and white are not only perceived as separate;

they are perceived as different. The black triangle is perceived as the figure, while the white, if it is noticed at all, is perceived as background. The figure stands out from the ground, which appears to extend behind it. If you reached out to grasp any part of the design, you would grasp the figure, not the ground. And, after you look away, you are more likely to remember the figure than the ground. If you look at *B* of Fig. 5.1, you will see that the brightness difference is the same; the black and white are easily differentiated, but neither is clearly the figure, so none of the above statements can be made. In general, if one part is small while the other is large, homogeneous, and inclusive, the small part will be perceived as the figure.

In auditory perception a voice is often the figure and random noise the background, but in continuous speech and also in music a pause between sounds can be the figure if the timing is right. Kinesthetically a movement may be the figure, the posture or stance being the background against which this movement is perceived.

Other patterns are organized according to certain principles of perceptual organization which can be illustrated by some artificial patterns. Fig. 5.2 has been drawn to show how two principles, proximity and similarity, can be experimentally used to shift perception one way or the other.

Proximity. The standard pattern in *A* is composed of square elements, all similar, and each the same distance horizontally and vertically from the next. It is an ambiguous figure that can be perceived as seven vertical columns or seven horizontal rows. When the horizontal distance is increased, while the squares remain in proximity vertically, as in *B*, one perceives columns. When the vertical distance is increased, while the squares remain in horizontal proximity, as in *C*, one perceives rows. As a rule, stimuli in close proximity are grouped together and perceived as parts of one pattern, while stimuli farther away are perceived as parts of another pattern. When the stimuli are sounds, proximity in time operates in the same way and determines the rhythm we perceive.

Similarity. Objects that look the same are grouped together. Therefore, in *D* we see columns though proximity has been held constant. The effect would be even stronger if the squares were yellow and the crosses were blue.

Like other psychological processes, perception does not depend on one factor alone. Proximity and similarity have been combined in *E* so that they work together and the resulting pattern is clear cut.

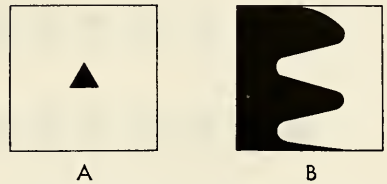


Fig. 5.1. Figure and ground relations. In *A* the triangle is unequivocally the figure and the white space the background. In *B* either the white space or the black can be perceived as figure and the other as ground.

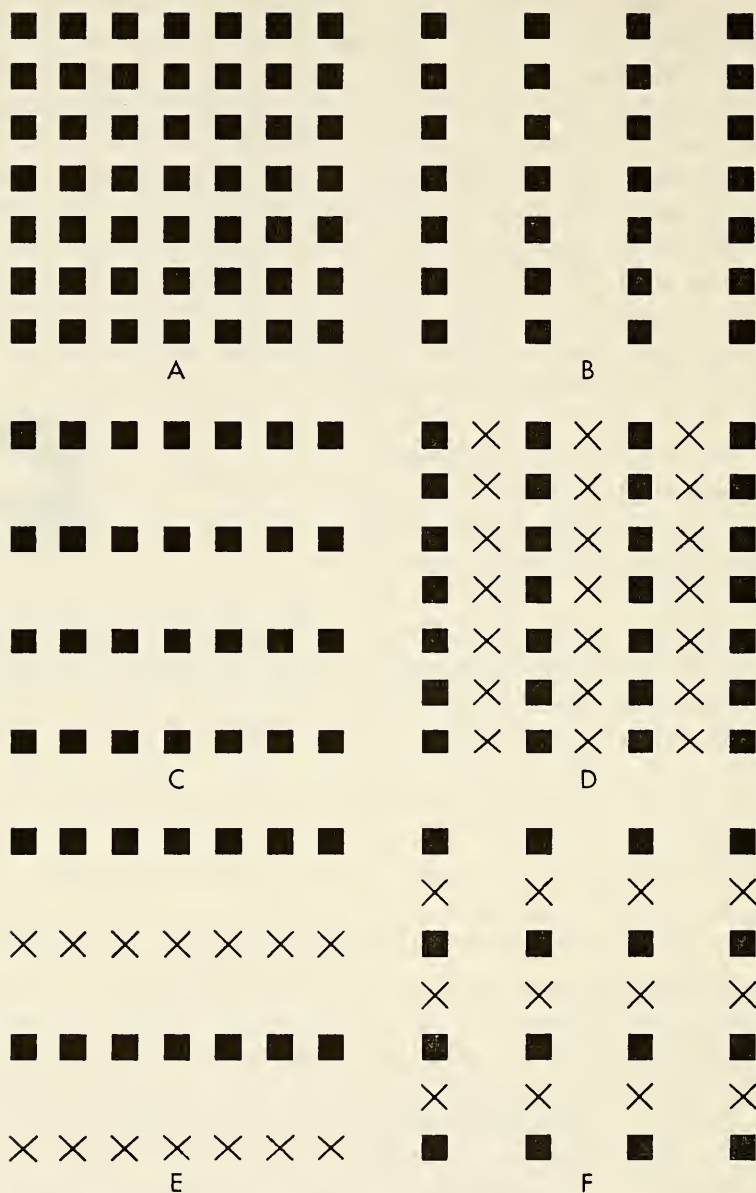


Fig. 5.2. Artificial patterns to illustrate the effects of proximity and similarity on perception. A is an ambiguous pattern, which may be organized vertically and perceived as seven columns, or horizontally as seven rows. When the vertical distances between the squares are less than the horizontal distances, as in B, the pattern is organized vertically and appears as four columns. When horizontal distances are less than vertical distances, as in C, the pattern is organized horizontally, as four rows. D, as compared with A, shows how similar elements are grouped, in this case to favor the vertical organization. In E similarity and proximity work together to strengthen the horizontal organization, while in F these effects are opposed and the pattern is ambiguous.

Continuity. Fig. 5.3 has been drawn to illustrate the principle of continuity. Stimuli that run together to form a continuous line or circle are grouped together. Part A of Fig. 5.3, for example, could be perceived as two intersecting straight lines or as two angles touching each other, but continuity favors perception of two straight lines. If the continuity is broken,

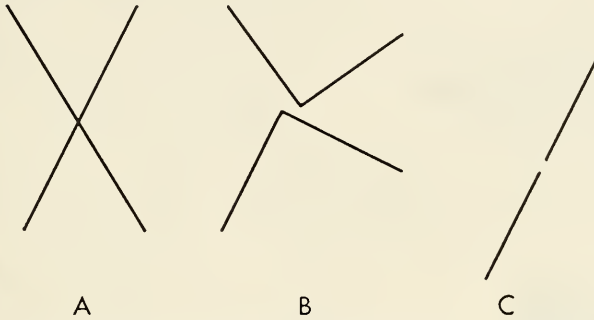


Fig. 5.3. Continuity in perceptual organization. A is perceived as two intersecting straight lines, but when the continuity is broken up, as in B, we perceive two separate angles. A break, as in C, is easily closed if the segments are continuous.

as in B, we perceive two angles. This is not the same as the proximity principle because C is perceived as a straight line in spite of the distance between the segments. The tendency to close the gap is called *closure*. The continuity principle may be strong enough to overcome the lack of similarity in Fig. 5.4.

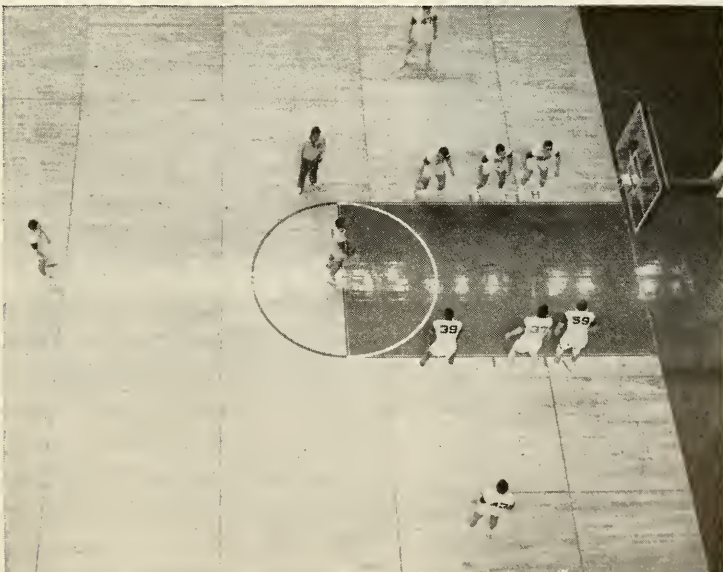


Fig. 5.4. Continuity overcomes the lack of similarity so we perceive a complete circle. (MSU Information Services)

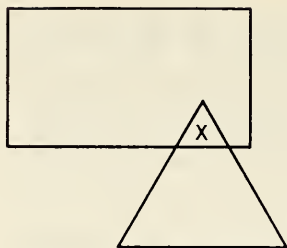


Fig. 5.5. Frames of reference. The X may be located with reference to alternative frames.

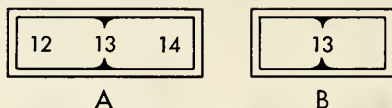


Fig. 5.6. Window dials. The adjacent numbers seen in A supply a frame of reference which is lacking in B.

Whole-Part Relations. A large pattern is organized out of little parts, as everyone knows, but perceptually the reverse is also true. Perception of any part of a pattern is strongly influenced by the whole pattern that it is part of.



Fig. 5.7. Total organization and contrast. The girl is perceived as a uniform gray when she is perceived as a complete pattern. Now place a pencil or a ruler across the page so that the lower half is distinctly separated from the upper half. Under these conditions the lower half is contrasted to the black and looks lighter than the upper half, which is contrasted to the white.

When the X of Fig. 5.5 is perceived as part of the rectangle, it is in the lower right corner. When it is perceived as part of the triangle, it is at the top. The location of an object is determined by the pattern to which it is referred. In such cases, the pattern is called a *frame of reference*. It is important to note that the frame may not be noticed, or remembered, yet it determines the perception of the object that is framed. A man six feet tall playing with a basketball team will probably look short. He will be remembered as short even when the background or frame within which he looks short has been forgotten, and one may be surprised later to see how tall he is in reference to ordinary men. By the same principle the window dial in A of Fig. 5.6 can be read more accurately than the dial in B because the additional numbers supply a visible frame of reference for the number near the pointer. Contrast, as illustrated by Fig. 4.2, is a special case of this principle, but even contrast is influenced by whole-part relations, as in Fig. 5.7.

Not only does the whole pattern determine how the part is perceived; it

may determine whether it is perceived at all. Often when the outlines of the part are included in the larger overall pattern, the part loses its identity. This principle, known as the *embedding* of the part in the whole, is illustrated in Fig. 5.8. Complicating the pattern is not the same as embedding, as Fig. 5.9 demonstrates.

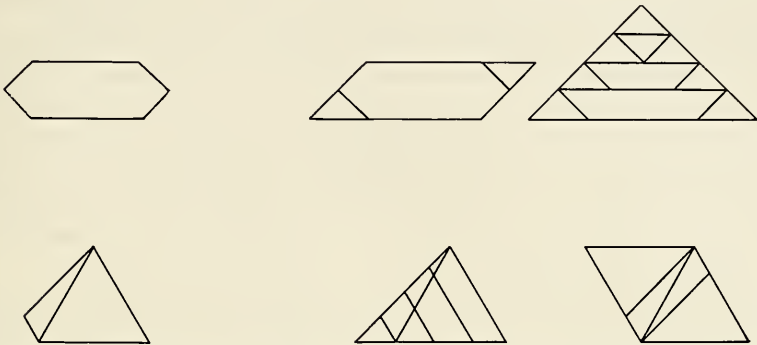


Fig. 5.8. Embedding. In each row the figure on the left is concealed in each of the figures on the right. Can you disentangle the figure from the pattern in which it is embedded and see it clearly?

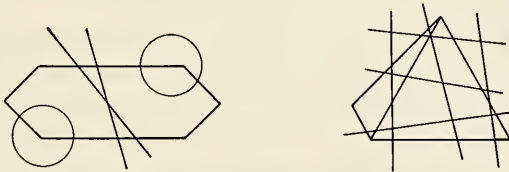


Fig. 5.9. Complication without embedding.

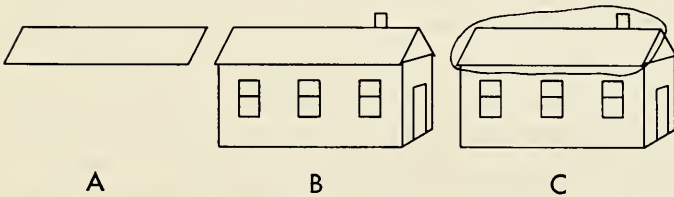


Fig. 5.10. Concealing and revealing. A is perceived as a two-dimensional figure, a parallelogram. When it is embedded in B, it is perceived as a rectangle inclined at an angle. Isolating it from the rest of the pattern, as in C, restores its two-dimensional character.

The principle of embedding may also be applied to the perception of typographical patterns. It is difficult to find an animal word in the following line:

A Robe A Robe A Robe

It is easier to perceive an animal word in this line:

opilabearstuvy

And it is very easy to perceive it in this line:

opila BEAR stuvy

This is a good principle to know if you have to conceal something without covering it. Make the outlines part of some larger pattern that need not be concealed. And, in reverse, if you wish to make something stand out prominently, separate it from its surroundings (the proximity principle) and make it different from its surroundings (the similarity principle) by coloring it or using different type, as in the third line above. Fig. 5.10 shows how a parallelogram on the page can be changed to a rectangle inclined at an angle by embedding it in a larger pattern and how it recovers its identity when isolated from the larger pattern.

Pickpockets also make good use of this principle. They work in crowds so the movements they wish to conceal are embedded in the usual accidental pushing, or they have an accomplice perform the innocent pushing. In the same way it is possible to conceal a yawn by including it in a cough—or better yet in a smile.

Movement. Objects in the world move and the perceiver moves. In either case the movement changes the pattern of stimulation that reaches the sense organs, usually by changing the distance between parts, breaking up continuities, and changing whole-part relations. Fig. 5.11 is drawn to show how movement interacts with proximity. Standing

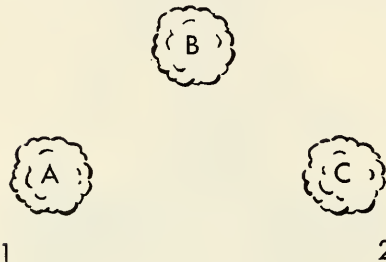


Fig. 5.11. Trees viewed from two positions. Predict which tree B will be grouped with when viewed from 1 and when viewed from 2.

at 1 the perceiver groups tree A and tree B together, with tree C to one side. When he walks over to 2, he perceives tree A to one side and trees B and C together. If he walks around the trees, the groupings will change continually.

When a solid object moves or when an observer moves around it, proximity and similarity factors in the object change only slightly while relations between the object and the background change greatly. When an observer stands at 1 in Fig. 5.12, he may not see tree A because it is lined up with tree D and embedded in the outlines of D. When he stands at 2, it is lined up with tree C and embedded in the outlines of C. But when he walks from 1 to 2 while looking at tree A, the background changes continuously, and tree A will stand out clearly as different from this background. Under these conditions the sharpest and most stable contrasts we see are at the edges of

objects, and thus the object is perceived as one thing, separate from the background. Alert observers take advantage of this principle automatically, by moving the head to get a different slant on a confusing scene or by walking to a better point of view.

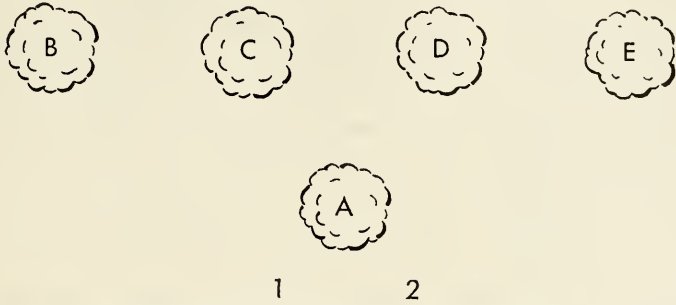


Fig. 5.12. The point of view. As the observer moves from 1 to 2, tree D is revealed and C is concealed.

Organismic Factors

Familiarity. Among the variables in the individual that influence perception, familiarity and set are the most important. Other things being equal, we perceive those patterns that are familiar to us because of previous learning. This arrangement of lines could be organized in several different patterns, but we have learned by years of practice to organize them into letters and words. If you turn this book upside down, the letters will be hard to perceive, but if you had spent as many years reading upside down as you have right side up, it would be easy.

The expert mechanic listens to the sound of a disabled motor and puts what he hears into familiar patterns, patterns that are different from those heard by the novice. Critical sounds become figure and the rest is background. The experienced radiologist, looking at an X-ray picture of his patient's chest, picks diagnostic signs out of the shadowy background, while the anxious patient sees only blurs overlapping other blurs. The zoologist, looking at animals, groups similar together and perceives ungulates, echinoderms, and insects, while the hunter by the same process perceives edible and inedible targets, or legal and illegal game. The perceiver's training, the names and classifications he has learned, help to chart the latitudes and longitudes of his perceptual organization. Chapter 7 describes how this perceptual learning occurs.

Familiarity is the reason why a dial like A in Fig. 5.13 is read with fewer errors than a dial like B. Even the relation between figure and ground can be reversed by controlled practice in the laboratory if the two are not too

dissimilar.¹ And it is probably the reversal of familiar figure-ground relations that makes some modern sculpture perceptually intriguing (see Fig. 5.14).

Set. Perception is an active process. No animal worth his salt, certainly no human animal, bides his time passively waiting for the light to hit his

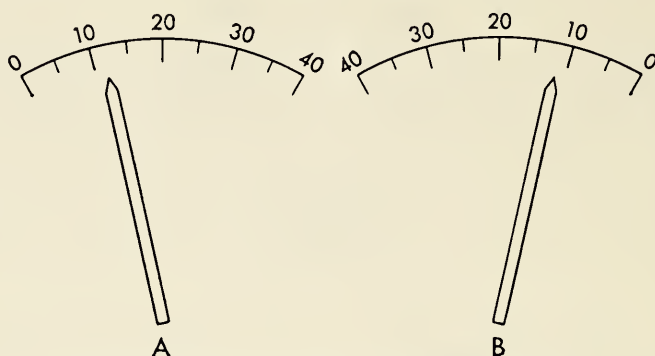


Fig. 5.13. Dials with familiar and unfamiliar scales.

retina or the sound to hit his ear. He not only sees, he looks. He not only hears, he listens. Chapter 3 described how the individual gets set in advance to attend to the stimulus, and this set influences perception of the stimulus when it comes.

Consider how the set can influence the perception of an ordinary table. Suppose you enter a room with an armful of books and then you have to tie your shoelace. You look for a place to rest your books, and with this set you perceive the table as a horizontal surface at a convenient height. It is like a shelf or window ledge. Next, suppose you have to dash out of the room in a hurry and the table is in your way. With this set you perceive it as an obstacle to be avoided. It is like a filing cabinet or bookcase or any bulky thing that you have to circle around. Or suppose you are looking for a place to hide something. When

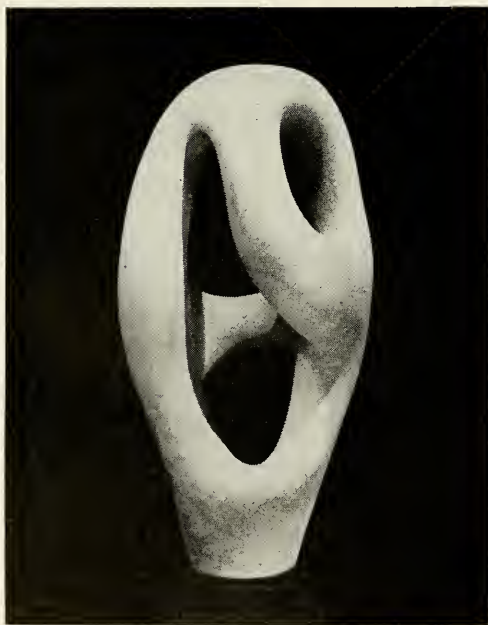


Fig. 5.14. *Ptolemy*, by Jean Arp. The modern sculptor's treatment of space and solidity offers the viewer an intriguing problem in figure-ground relations. (From *The Museum of Modern Art*, by permission of Mr. William A. M. Burden)

set in this way, you perceive that the table has a drawer, which you did not perceive under the influence of the other two sets. Finally, suppose you are sketching the table. Now you notice perspective, shadows, highlights, and interesting details. A shadow falling on part of the table does not impress you when you are looking for a place to put your books, but when you are trying to sketch the table, the part in shadow looks darker.

Although perception is an active process, we must not conclude that everything which influences perception is noticed by the perceiver. We have seen that perception of the figure is influenced by the ground even though the ground as such is not noticed. Likewise, if you ask the perceiver what he sees, he will report the objects that are important to him at the moment and may not mention the perspective, the lights and shadows, or the background, even though it can be proved that perception would be different if these were different. Such stimulus patterns, which are not the objects of perception but signs of objects or hints for the perception of objects, are often called cues to perception. When perception is difficult, the observer makes use of any cues that are available, often unknowingly and perhaps erroneously.

We know from Chapter 3 that a set can be established by instructions from one person to another, and laboratory experiments have demonstrated that such instructions can establish a set that slants perception in various directions. In one experiment of this kind a group of observers were told they were going to see some travel words and another group were told they were going to see some animal words. Then the same words were exposed briefly to both: "sael," "wharl," "dack." Those who expected to see travel words perceived 74 percent travel words, such as "sail," "wharf," and "deck," and only 11 percent animal words. Those who expected to see animal words perceived 63 percent animal words, such as "seal," "whale," and "duck," and only 14 percent travel words.²

Previous experience, as noted above, gives the advantage to perceptual patterns that are familiar. More than that, previous experience helps to establish a set to look for certain patterns rather than others. A zoology student who spends a summer classifying butterflies may acquire a set to classify that is reinstated whenever he sees some butterflies. A medical student studying chest X-rays for the first time is likely to see the pattern that he studied in the textbook rather than the pattern in front of his eyes.

The function of the set can be appreciated by considering the activity of searching for something. If an animal is hungry, he goes searching for food. The motive organizes a set that sensitizes him to the smell of food and he is more likely to perceive food than when he is not thus prepared. In the same way a boy who is looking for his ball is set to perceive spherical objects of a certain size and color. If he is looking for an unknown or vaguely described

object, he is less likely to find it because he does not know exactly what he is looking for and cannot prepare a set that will help him perceive it. In general the search is more successful when the object of the search is described or visualized in advance.



Fig. 5.15. Inkblot. What does it look like?

Emotions and motives may capture the set and organize perception. A strong emotion like fear can make a person perceive danger on all sides. People have been known to shoot fence posts and bushes when they anticipate danger. People who feel guilty occasionally hear voices accusing them of horrible crimes. The influence of milder dynamic factors has been studied in the laboratory and clinic with the aid of inkblots, like the one shown in Fig. 5.15. The advantage of inkblots for this purpose is that they are ambiguous. Such factors as proximity, similarity, and familiarity are minimized, so the blot can be organized in many different patterns. When college students skip a meal or two, they are likely to see food objects in the inkblots. When they have been shocked for pronouncing certain classes of words, they seem to inhibit perception of such words. But it has been much easier in the laboratory to slant the set for perception by manipulating instructions than by manipulating motivation.

Biological Utility of Perceptual Organization

To bring these principles together, let us consider their biological significance for the living organism. Perception is the process by which living animals find what they want on the surface of this earth and detect the presence of danger. A perceptual system that can grasp the pattern of a tree and retain that pattern from different points of view is a necessity for any mobile organism. There is an advantage also in a perceptual system that is selective, that is tuned up and guided by the organism's preparation for action. The most useful perceptual system would be responsive to both physical stimuli from the environment and the organism's set.

Perception is useful but not perfect. Perceptual mechanisms, operating according to the principles described above, make it possible for the mobile organism to adjust to its natural environment most of the time but do not guarantee that this adjustment will be flawless. Under many conditions the perceptual mechanisms form conflicting patterns. Proximity and similarity may compete as well as cooperate, as illustrated in Fig. 5.2. The set may slant

perception toward one pattern and familiarity may slant it toward another. When this happens, as when a threatening sound cannot be localized, or when an object is seen in one place and felt in another, the perceiver cannot adjust to his environment. He is confused, and confusion itself is motivating. The individual tries first one pattern of organization, then another, until he can integrate an inclusive pattern that does not interfere with his activity. What he perceives, then, is the resultant of many different factors, some in the stimulus situation, some in the perceiver, all of which add their contribution to the final perception and any of which may, when the conditions are right, play the dominant role. All of these principles can be made more specific in the next sections by considering a few typical perceptual problems that the individual encounters during his 24-hour tour of duty.

PRACTICE PROBLEMS

- Figure has the same relation to ground as fovea has to (a) rods; (b) cones; (c) blind spot; (d) periphery.
- Why is the sun perceived as figure and the sky as background? (a) Sun is closer; (b) sky is larger; (c) sun is brighter; (d) familiarity.
- Knowing that the sun appears as figure and the sky as ground, what can you predict?
 - The sun will appear in front of the sky.
 - The sun will be perceived as brighter.
 - The sky will appear well organized.
 - The sun will be embedded in the sky.
- What principle of perceptual organization accounts for what the zoologists call "protective coloration"? (a) Proximity; (b) similarity; (c) continuity; (d) embedding.
- Chapter 2 mentioned several defense reactions, such as diving, growling, and stinging. What kind of defense reaction would you expect in animals that have protective coloration?
- Why is it difficult to locate a small point of light on a dark night?
- The rings of Fig. 5.16 appear to be intertwined because of (a) contrast; (b) familiarity; (c) continuity; (d) embedding.

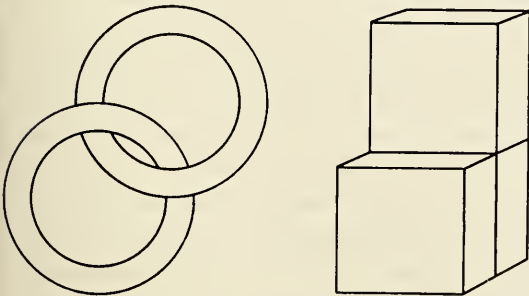


Fig. 5.16. Two problem pictures.

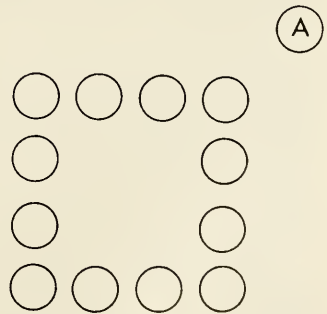


Fig. 5.17. The raven and the flowerpots.

8. Anyone who perceives three blocks in Fig. 5.16 is influenced by (a) familiarity; (b) whole-part relations; (c) set; (d) proximity.
9. In the study of perception proximity is (a) an inference; (b) a construct; (c) a physical variable; (d) a psychological variable.
10. When food was hidden in flowerpots arranged as in Fig. 5.17, a raven was able to find the food only when it was hidden in the pot marked A. Why? (a) Embedding; (b) proximity; (c) similarity; (d) set.
11. Using the principles of embedding, predict on which of the suit patterns of Fig. 5.18 dirt would show least.

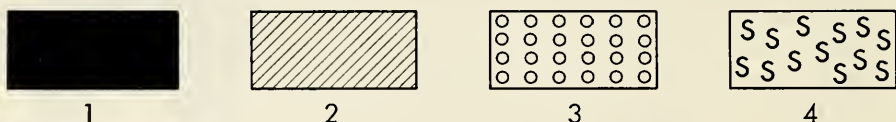


Fig. 5.18. Which fabric will show a stain least?

12. Laboratory experiments have shown that practice can influence what is perceived as figure and what is perceived as ground. Would you guess that such experiments have used patterns like A of Fig. 5.1, or B?

PERCEPTION OF OBJECTS IN SPACE

Keeping the organism informed of the location of objects around it, a primitive function of the perceptual apparatus, is carried out in several ways, by several senses. Naturally any wide-awake individual collects information from several senses whenever possible.

Tactual Identification

An object on the surface of the skin may be located by vision or by touch. An object within arm's length may be located by vision, touch, or kinesthesia. In this mechanical age many gadgets in the kitchen, the automobile, and the factory have several controls, such as switches, knobs, levers, push buttons, and handles, not always visible, that have to be identified tactually. The automobile driver, for example, must discriminate the brake pedal from the accelerator and the light switch from the cigarette lighter. The controls on some automobiles and some electric stoves are designed so that they all look and feel the same, and the possibilities of confusion are maximized. In most shower baths the hot-water control and the cold-water control feel the same, so anyone with soap in his eyes finds it hard to distinguish them.

The problem of tactual identification is particularly important for the airplane pilot because of the large number of controls he has to operate. One study of this problem began with the 16 handles shown in Fig. 5.19 and found that some were frequently confused with others, but experimen-



Fig. 5.19. Handle shapes. When vision is not permitted, many of these are confused with others, e.g., the triple groove with the cross, but research discloses a set of eight (marked thus*) that can be differentiated with high accuracy after relatively little practice. (From Green & Anderson³)

tation turned up a set of eight that were quite well discriminated from each other. Furthermore the average airman could learn to identify these handles without error in only nine trials.³

Auditory Localization

Most localization of objects comes through the ears and the eyes. In general, there are two problems: finding the direction of an object and finding its distance from the perceiver.

Direction. To find the direction of an object, such as a barking dog, the ears and eyes usually cooperate, but the contribution of each can be studied separately by plugging the ears or covering the eyes. When a person cannot see the source of a sound, he can still locate its direction moderately well if he has two good ears. Plugging one ear and walking down a busy street will convince anyone of the necessity of two ears for auditory localization. If a sound originates anywhere to the right of the perceiver, it will arrive sooner and with more strength at the right ear than at the left ear. If the sound originates in the median plane, that is, straight in front of, or behind, or

above, the observer, it will be the same at both ears. Thus we have two differences in the stimuli that can act as cues for localization: *time difference* and *intensity difference*.

The threshold for auditory localization is about three degrees. That is, if the sound originates at an angle of three degrees or more to one side of the median plane, the average observer can usually tell which side it is coming from. Knowing the speed of sound, the size of the head, and a little trigonometry one can compute that under these conditions the sound reaches the near ear about 0.00003 second before it reaches the far ear. It may be surprising, but the average person with normal hearing can make use of a time difference as small as this. Further proof comes from putting earphones on the observer and leading an electrical signal to each ear at various time differences. If the time difference is very small, the observer, instead of hearing two sounds, integrates these stimuli into a pattern and perceives one sound. If the sound reaches the right ear 0.00003 second before it reaches the left ear, he usually localizes it a little to the right. If it reaches the right ear 0.0007 second sooner, he will localize it straight out at the right. If the time difference is much greater than this, the observer hears two sounds.

The intensity difference is unimportant when the sound is a block away. When the sound is close, it comes directly to the near ear, but to reach the far ear it has to bend around the head, so the far ear is in a kind of sound shadow. Sound waves of low frequency, which have long wavelengths, can bend around the head quite well, so the intensity difference is negligible. Sound waves of high frequency, which have short wavelengths, do not bend around obstacles; they travel only in straight lines, like light waves. You can get the picture by recalling how waves on a pond bend around a rock. Narrow waves are stopped by a rock; wide waves envelop the rock and keep going. Thus it turns out, on careful experimentation, that the intensity difference is a useful cue to direction only when the sound is close and when it has a frequency above 3000 cycles per second. Bats fly around in the dark by sending out sounds of about 50,000 cycles per second, which bounce back from obstacles in straight lines, like light.

You can perform some instructive experiments if you put two small radios on a table about head high and tune them to the same station. Lead a blindfolded person into the room and seat him in front of them, then, without telling him there are two radios, ask him to point to the sound while you turn the volume control of one of them up and down. In small rooms reflections from the walls may confuse the results somewhat.

Both the time difference and the intensity difference depend on the cooperation of the two ears. Thus we can perceive the right-left direction quite well. If you put one radio on a table and move it right or left, a blind-

folded observer can follow it with his finger quite well. If you move it in the up-down dimension or the front-back dimension, errors of localization will be much larger. It would be convenient to have another ear, located perhaps on top of the head. Mechanical direction finders for locating submarines, land mines, oil deposits, and airplanes have three receivers.

The experiments described above were done with the head in a fixed position, but ordinarily movements of the head improve localization. Errors in the up-down and front-back dimensions are reduced when the observer turns or inclines his head, so as to get a bearing on the sound from several angles. Walking back and forth also helps, especially when the sound is reflected from walls or hills.

Sound movies can be made somewhat more realistic by making two records from two separated microphones and playing them back from two correspondingly separated reproducers. Thus, when a horse gallops left to right across the screen, the left and right ears of the perceiver in the theater are stimulated approximately as the left and right microphones on the set were stimulated.

Distance. Perception of the distance of a sound source is not very accurate. However, if the sound is continuous, like a train whistle, we can tell whether it is approaching or leaving by the increase or decrease in loudness. If the sound is a complex one, some frequencies will carry through distance and around obstacles better than others, and an observer in familiar territory can make guesses on this basis.

How the Blind Perceive Space. Blind people, having lost the most valuable sense, find their way around by making good use of their other senses. They get information about floors, sidewalks, curbs, and stairs through their feet, especially in familiar territory. Barriers may block sunlight and wind, and on a warm day a wall reflects heat. They can also estimate the distance of obstacles, such as a brick wall, by auditory cues. They make sounds with their feet as they walk, and these sounds are reflected back from the wall. As they move closer to the wall, the reflected sound pattern changes. They have more collisions when walking on grass, or a thick carpet, or in stocking feet.

This auditory perception of obstacles requires practice. Some blind people do much better than others with equally good ears. Blindfolded college students can learn this trick fairly well with a few days of training.⁴

Visual Localization

Vision is the only sense that gives us an extended organized pattern of space and the objects in it. One reason is that light is modified by the objects that reflect it, so that the stimuli reaching the eye are related to the many reflect-

ing objects rather than the few original sources. We have the same two problems of direction and distance, as in auditory localization, but the eye is better equipped to handle them than the ear or any other sense.

Direction. Most of things we wish to locate are surrounded by other things, and we locate one thing in relation to the frame of reference formed by others. We see an object as above or below the horizon, right or left of a hill, and so on. Light rays from the objects are funneled through the pupil to spread out on the retina, so vertical and horizontal dimensions of the retinal image are proportional to the vertical and horizontal dimensions of the objects and distances between objects. Since there are so many receptors packed into the retina and the threshold visual angle is so small, as noted in the preceding chapter, judgment of vertical and horizontal dimensions is very accurate. The image on the retina is inverted, of course, but this is not important because the image is translated into neural impulses anyway.

Distance. When we try to perceive how far away an object is, the visual task is much less direct and the judgments are less accurate. The visual task is often called depth perception or perception of the third dimension, the other two being the vertical and the horizontal. How does anyone looking out the window perceive that the window is close and the trees are farther away, while the clouds are even farther? Why does a ball look like a solid sphere rather than a flat circle? The light coming from a ball to the eye is projected on the retina as a circle, with the vertical and horizontal dimensions represented quite accurately, somewhat as pictures appear on a two-dimensional page of a book, but the third dimension is not represented. The

question is how anyone with only a two-dimensional retina can perceive a three-dimensional world. The artist has a similar problem: how to represent a three-dimensional world on a two-dimensional canvas. Much careful research has been directed toward this question, and we know that there are several answers. Depth can be perceived in many ways, and the alert observer picks up all the cues he can. The artist, likewise, uses several devices.

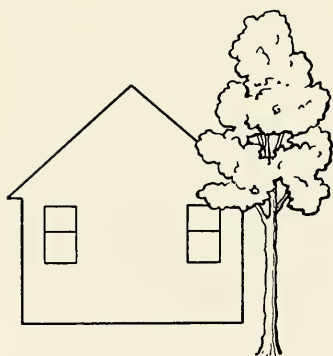


Fig. 5.20. Overlapping.

One simple but very effective cue for distance is the *overlapping* of the outlines of one object on another—also called interposition. If part of the outline of a house is interrupted by the outline of a tree, the house appears nevertheless to be a complete pattern, because of continuity and familiarity, and it can be perceived as complete only if it is perceived as extending behind the tree (see Fig. 5.20). The artist uses overlapping frequently to get depth ef-

fects, and the fact that we can sketch Fig. 5.20 on a two-dimensional page proves that we have not exceeded the two-dimensional limitations of the retina. The photographer chooses his angle so as to take advantage of overlapping if he wants to emphasize depth.

Shadows also contribute to the perception of distance and solidity. When light comes from above, as it usually does, a hole will have an inside shadow on the side toward the light and a protruding ledge will have an outside shadow on the side away from the light. The observer takes account of the direction of the light, either from seeing the source or from seeing other shadows, and builds up an impression of depth from the way the shadows fall (see Fig. 5.21). The landscape painter and the portrait painter put in shadows deliberately. The photographer can create shadows by arranging studio lights, or he can choose a time of day when the sun gives him the shadows he wants. Fig. 5.22 shows the combination of shadows and overlapping.

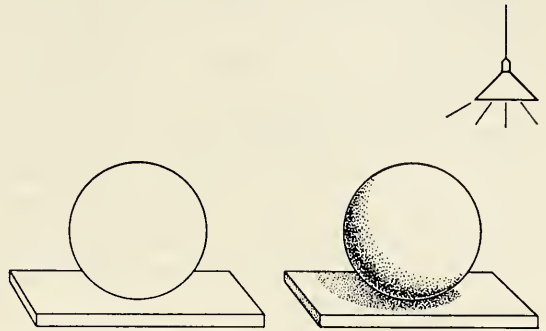


Fig. 5.21. Shadows and depth.

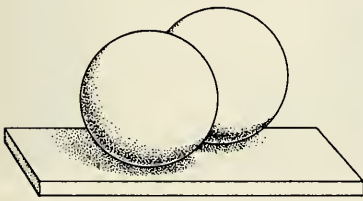


Fig. 5.22. Combination of shadows and overlapping.

Fig. 5.22 shows the combination of shadows and overlapping.

A third cue for perception of distance is the *relative size* of near and far objects. The parallel lines in A of Fig. 5.23 are ambiguous because those that are higher on the page could be smaller than the lower ones, or farther away. If all lines are joined in some kind of pattern, as in B, they all appear the same size and thus the smaller ones are perceived as more distant. This distance effect is strengthened when more objects are included and overlapping is added, as in C. The artist uses this device under

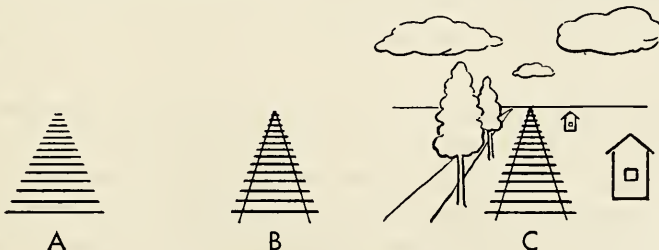


Fig. 5.23. Three degrees of organization of a plane.

the name of perspective, and when the objects are drawn in relative size, we perceive them based on a plane or ground which extends left and right and back to the horizon. Outdoors the near stones and blades of grass are relatively larger on the retina than those farther away, and this texture gradient alone can define a plane. We use relative size, overlapping, and any other cues we can get, to construct a plane, and we use this plane as a frame of reference to estimate distance or size. Typically the observer's eye—or his point of view, as we call it—is a few feet above this plane, and the artist and photographer usually adopt this typical point of view.

Indoors we use the relative size of floor boards or tiles to organize the plane of the floor, relative size of near and far edges of windows and doors to fix the plane of the wall, and similar cues for the ceiling. Familiarity is also an organizing principle indoors, biasing perception toward level floors and ceilings, vertical walls, and right-angled corners. Striking illusions can be produced when a distorted room is the frame of reference for familiar objects (see Fig. 5.24).



Fig. 5.24. Perception of size in a distorted room. To convince the skeptics Y and P changed places. (Courtesy Perception Demonstration Center, Princeton Univ.)

Another cue for distance is the *clarity* of things in the field of view. Objects at an extreme distance look fuzzy; the outlines are unclear. The reason is that the lines are blurred slightly by dust particles in the air, and perhaps colored a bit. In clear air the outlines are sharper; hence people going from an industrial city to the virginal air of Arizona may be fooled when they estimate the distance to the mountains. Landscape artists make use of this cue also.

These four cues for distance are monocular cues; they require only one eye. They can all be used by painters and photographers for getting the depth effect into a picture. All four depend on discrimination of relations: relations between outlines, between brightnesses, between sizes, or between degrees of clarity. In the landscape at the beginning of this chapter all four cues cooperate to produce the impression of distance.

A fifth cue for distance, *convergence*, requires two eyes. When an object is close, the eyes turn inward or converge on it. When it is far away, the eyes straighten out. Knowing that the eyes are about 64 millimeters, or $2\frac{1}{2}$ inches apart, if you know the angle of convergence of the eyes, you can compute the distance of the object on which the eyes are converging. The convergence movements are made by muscles attached to the eyes (see Fig. 4.7), and these muscles contain kinesthetic receptors which feed back information about the degree of convergence. Since the degree of convergence for any distance is always the same, it is possible to estimate distance from the kinesthetic feedback. This binocular cue is useful for distances up to 15 feet or so.

One of the best cues for depth requires both eyes; more than that, it requires that each eye get a different or disparate view, hence the name: *retinal disparity*. You can demonstrate this disparity by holding a finger in front of your face close to your nose and looking at it with each eye alternately. Much of the finger is seen by both eyes but the left eye sees a little more of the left side of the finger and the right eye sees a little more of the right side. Fig. 5.25 shows the same relationships in a different way. With the pencil in the position shown, the image falling on the right retina will be a trifle longer than the image on the left retina. The differences in the retinal images may seem slight, but remember that the eye is very good at this kind of comparison. We discriminate differences as small as 1 percent.

The best way to realize the definiteness of this cue is to raise the question, in connection with the figure: Why cannot the pencil be perceived at a different angle, with the point closer to the eye, as shown by the broken lines? The answer depends in part on the formation of double images on the retina. Ordinarily the eyes converge on an object so that the light rays from the object fall on corresponding parts of the two retinas and vision is clear. If the eyes are converged on the actual pencil, as the figure shows, light rays from a hypothetical pencil point closer would form slightly different images on the two retinas, not different enough to be separated, but overlapping and confusing. This confusion acts as a stimulus to perceptual

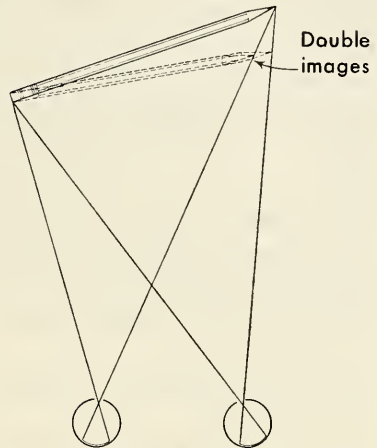


Fig. 5.25 Binocular disparity or parallax. The image formed by the light rays on the left retina is slightly different from the image on the right retina. Why is the pencil perceived where it is and not a little closer? See text for a simplified explanation. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

readjustment. The only way the fuzziness of the double images could be cleared up would be to push the perceived position of the pencil point farther back where the images fuse into a clear-cut pattern. By the geometry of the situation there is only one place at which this can occur, hence it is this distance that we perceive.

Recalling the principles of the organization of patterns, one can note here the operation of the principles of proximity and similarity. If the pencil point is seen in front of or behind its true position, double images will be seen. The images are similar, not very disparate, and in close proximity. Therefore the natural tendency is to close the gap, sliding them together, and when this is done, the geometry of the situation requires that they slide into the position of the point from which the light comes. Retinal disparity is a good cue for distance, effective for objects as much as 1000 feet away.

All of these cues for depth perception are made more useful by *movement* of the observer. Retinal disparity, like convergence, requires two eyes, but a one-eyed person can get the same two views that a two-eyed person gets if he moves his head $2\frac{1}{2}$ inches to the side. He has the handicap that he does not get these two views at the same time and hence cannot form them into a three-dimensional pattern quite so accurately. Movement also increases the information one gets from overlapping, as can be seen by looking back at Fig. 5.11 and imagining how the overlapping of *B* would change as the observer walks from 1 to 2. The movies cannot make use of convergence or retinal disparity (without special equipment); their special advantage is their movement.

Objects in Motion

A singing bird flying from left to right is perceived as moving because of changes in the time difference and the intensity difference at the two ears. If the bird is visible, its movement is seen within the frame of reference formed by trees, buildings, ground, and sky, just as the position of a stationary object is located within a frame of reference. Usually the eyes and the head move in pursuit of the moving object, so the image of the object remains centered on the retina while the image of the background moves across the retina in the opposite direction. But the moving object is perceived as the figure and therefore it, rather than the background, is seen as moving. The important condition for the perception of motion is not the motion of the object relative to the observer, or of the background relative to the observer, but motion of the object relative to the background.

It is not necessary that the moving object be heard or seen continuously. If the bird's flight is momentarily hidden when it flies behind trees and tele-

phone poles, it is not perceived as a different bird when it reappears but as the same bird moved to a different position. Likewise, when the pictures on a movie screen disappear and reappear 20 times a second, we see, not different objects, but moving objects. Perceptual organization covers time as well as space, and the principles of organization are the same. If the pictures of a movie or the lights of an electric sign change so fast that we cannot see them separately, we are forced to organize them in a pattern, and the principles of proximity and similarity apply to these as well as to stationary patterns. If a light goes out and two others come on immediately, the first light will be seen moving to the closer one. If they are both at the same distance, the first light will be seen moving toward the one which is more similar. For example, if a sparrow disappears behind a tree and another sparrow appears on the other side, we perceive one moving sparrow, but if a robin appears on the other side, the dissimilarity is too much and we perceive two separate birds. When solid objects are photographed moving in front of a background and projected rapidly on a movie screen, the principles of proximity, similarity, continuity, and the others listed at the beginning of this chapter all work together to give an impression of solidity, just as in the perception of the actual objects.

Integration and Conflict of Cues

Usually the observer integrates information received from several sources, through several sense organs—the more the better. That is why distances can be judged better in a diversified landscape containing objects than in a barren landscape or on the open sea. The observer uses cues from the objects to build up a perception of the ground or the sea as a plane sloping away from him and at the same time uses this frame of reference to locate objects.

Obviously the interpretation of many of these cues, such as shadows and relative size, and their integration into a perceptual unity requires practice. But children get plenty of practice early in their active lives. They learn perceptual habits and references, after which they perceive the world as a very constant place. But even adults can be fooled when they move to a very different environment or when different cues yield conflicting information⁵ (see Fig. 5.26).

When auditory and visual localization disagree, visual localization is dominant. This has been tested with a pseudophone, shown in Fig. 5.27, which conducts sounds from the left side into the right ear and sounds from the right side into the left ear. An observer wearing this device with his eyes closed heard sounds coming from the left as if they were coming from the right. When he could see the source of the sound, this reversal did not occur.

In other words vision is dominant over hearing. This is the secret of ventriloquism and this is why, in a movie theater, the sounds seem to be coming from the actor who is moving his mouth when they are actually coming from a box beside the screen.

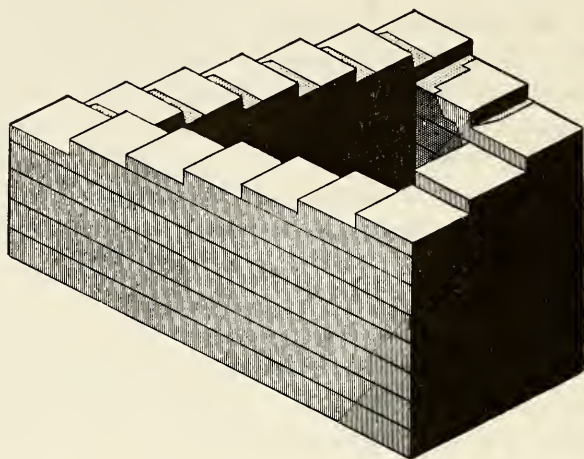


Fig. 5.26. An impossible object, or how to walk downhill all the way round. (From Penrose & Penrose⁵)

Psychologists have also worn lenses that twist the world around so that visual information disagrees with information from the tactual, kinesthetic, and vestibular senses. This is very disturbing at first, but after several days of practice with the distorting lenses they manage to get along fairly well.



Fig. 5.27. Young's pseudo-phone. Each ear receives sounds originating from the other side of the head. If the eyes are closed auditory localization is reversed. (Courtesy P. T. Young)

To tip the world to one side it is not necessary to wear glasses. In another experiment the subjects were fastened in a chair that could be tilted left or right in a small room that could be tilted left or right.⁶ When the room was in the usual upright position and the subject was tilted to one side, he could right himself, by turning a crank, quite accurately. Even with eyes closed the average subject could do this with an error of only two or three degrees—presumably by internal bodily cues from tactual, kinesthetic, and vestibular senses. If the subject remained stationary while the room was tilted, the subject frequently reported that he was tilting in the opposite direction. Some subjects became ill. When the subject attempted to crank the room back to the vertical

position, errors were large. In this situation the subjects fastened in a chair seemed to rely more on the external visual information from the frame of reference supplied by the room than on information from the internal bodily cues, though individual differences were large. When the observer walks around in a tilted room at an amusement park, he gets more complete feedback from the body senses and manages to maintain a vertical posture fairly well.

It is possible also to arrange conditions so that information from the physical stimulus disagrees with information from social interaction. The subject may be shown two lines of the same length and hear people say that one is longer than the other. How will he perceive them? Here as elsewhere there is no direct evidence on perception, but several experiments have demonstrated that the judgments the subjects report to the experimenter shift toward the social norm. Apparently the subjects who are most sensitive to social pressure try to perceive or at least to say they perceive the lines as they think the others do. A few hold fast to their own judgments.

Walking Down the Street

Let us put these principles of perception to work by following young Davey Stone out of the house and down the street.

When he bursts out the door, he enters a different physical environment. The air has a different temperature as it meets his skin and the inside of his nose. There may be a breeze bending the hair on the back of his neck and thus stimulating the touch receptors. He sees the familiar trees and houses and hears the traffic noises and the distant puffing of the 4:30 freight train. As he bounds down the stoop, the vestibular receptors in his inner ear and the kinesthetic receptors in his muscles and tendons are whetted in the way that is so delightful to all active boys. All these things are probably not perceived as such, but they are perceived as signals of the world outdoors, the promise of excitement.

Walking down the street under the trees, our hero might see the walk as a light, mottled, rectangular surface but, his interests being what they are, he will probably see it as a path, a means of getting from here to there. The visual stimulation reaching his eyes from the walk is very irregular, as part of it is in sunlight and part in shade, but he takes all that in at a glance. Though he could not describe the process, he takes illumination and shadows into account and walks firmly down the sidewalk stepping on light and shade without hesitation. But, if one should ask him to look at the shadows, he could change his set and judge size, shape, and brightness as well as the next boy. Or, if he were looking for something to sharpen a knife, he would see the cement walk in still another light.

Along the street come a man and a woman. Our hero groups them as two of a kind, two adults to whom one must be polite. Next a man and a boy approach. These are not grouped as two of a kind but are perceived as one who is interesting and one who is not. Three boys come next. Will he perceive three boys-to-play-with or two boys-to-play-with and one to-be-avoided? The answer depends, of course, on our boy's previous experience.

PRACTICE PROBLEMS

13. What three senses can analyze movement in three dimensions?
14. If you had another ear, would you want it at a fixed distance from the other two?
15. Which would be harder for a blind person to perceive, a step up or a step down?
16. We often see shadows but do not see the light that casts the shadows. In these cases do we assume that the light is coming from above or from below?
17. Why do photographs of faces lighted from below look bad? (a) Distance; (b) familiarity; (c) whole-part relations; (d) relative size.
18. Does the clarity cue for distance show up in photographs?
19. Would you expect a worm to have good depth perception?
20. Would you expect a bird to have good depth perception?
21. In terms of the visual angle at which stimuli can be separated, which has the best acuity, the eyes or the ears?
22. What can a person with only one eye do to substitute for retinal disparity?
23. Why is convergence not useful as a cue for distances beyond 15 feet?
 - a. The eyes become almost parallel.
 - b. The focusing of the eyes is not accurate.
 - c. The kinesthetic receptors are not very precise.
 - d. The two eyes get slightly different views of the object.
24. From what you have read in this chapter would you expect that a blind person walking down the street would make more use of high-frequency or low-frequency sounds?
25. A dictionary defines a stereoscope as "an optical instrument through which two pictures of the same object, taken from slightly different points of view, are viewed, one by each eye, producing the effect of a single picture of the object, with the appearance of depth or relief." Which cue for depth perception is emphasized by the stereoscope?
26. Visual localization is to auditory localization as retinal disparity is to _____.

PERCEPTION OF WORDS

Man is a sociable animal who spends much of his life communicating with other sociable animals. A little of this communication is done with gestures and signal lights, but most of it is done with words. Single words, like STOP and EXIT, may be perceived as cues to immediate action, but spoken and printed sentences are usually perceived as information which can be either used immediately or stored away for later use.

It is a very remarkable performance. Man is the only animal that does it

well, and he needs years of practice. Most college students can perceive speech at 200 words a minute and can read a book at 300 words a minute. If each word has five letters on the average, the reader is perceiving 1500 letters a minute. When we remember that each of these letters is one of 26 similar patterns, the perceptual performance seems even more remarkable.

The speed attained in reading seems less startling, however, when the reader's task is examined more closely. It is true that to identify *e* and discriminate it from *a*, *o*, or *c* would require 0.2 second or more if it were done as a single operation. To identify 1500 of these letters would take five minutes rather than one, with the combining of the letters into words still to be accounted for. But the perceptual task of reading printed words or listening to spoken words is not one of discrimination. It is not the same as picking the louder of two similar sounds or finding the hidden face in a puzzle picture. It is more like walking down the street or driving an automobile. One pushes rapidly along, taking in only as much as necessary to stay on the right path and avoid uncertainty. The perceiver is set to get the information he wants, not to perceive everything he can.

If our language were constructed so that every letter and every word brought information that the perceiver needs, listening and reading would go much slower. But some letters and sounds are superfluous or redundant. *Redundancy* is the technical term for the fact that the English language, and every other language known, includes more words than are necessary and thus transmits information in several overlapping ways at once. When you see the letter *q*, you will know it will be followed by *u*. When you see *severa*, you know it will be followed by *l*. When you see *ps chol gy*, you fill in the pattern without difficulty. The arrangement of words in sentences is similarly redundant. When you see or hear, "I think is going rain," you can close the gaps easily. From one point of view our language is inefficient because it uses more letters and words than necessary. If we learn to use it more efficiently, then the reader can still make sense out of it. From another, more human point of view it is very efficient because it transmits information in spite of gaps and errors. Even if the type is mutilated, we can still read it.

Word patterns are perceived according to the principles of perceptual organization described earlier in this chapter, especially familiarity, frame of reference, and set. The first words perceived establish the frame of reference or context for the words to come, and within this context the perceiver extracts what information he wants, skipping over trivial details, filling gaps, and even correcting errors. For example, there are two typographical errors at the top of the page which may not have been noticed.

A printed word is a visual pattern, usually black ink on white paper, and a spoken word is a sound pattern. The words may be written by hand or printed in various type styles, in capitals or small letters. But after much

practice the reader perceives all these patterns as the same word: Psychology, PSYCHOLOGY, *psychology*, **PSYCHOLOGY**. The spoken word varies even more than the printed word.⁷ A word spoken by a soprano makes a different pattern of sound frequencies from that made by the same word spoken by a bass, and in either case it is different at the beginning of a sentence and at the end of a sentence (see Fig. 5.28). But these variations have little significance for communication. The child learning words learns to look for and listen to the standard patterns and ignore the minor variations just as he learns to recognize his mother in spite of variations in clothing. (But he can also change set and, ignoring communication, differentiate a soprano from a bass or a male voice from a female voice.) If all goes well, after much practice the spoken word and the written word are interchangeable. The perceiver can read a word in his own language and speak it, or hear a word and write it. Experiments have demonstrated that sentences which are hard to read are hard to listen to. A word, then, is the standard visual or auditory pattern by which the writer or speaker communicates to the reader or listener, and the perceiver's perceptual task is to identify words and skip

over redundant details that do not communicate anything.

Printed Words

In a page of ordinary type, like this one, the reader takes in from 10 to 20 letters, or 2 to 5 words, at a glance. The eye lingers at one point just long enough to perceive the words, not necessarily long enough to understand the meaning, then jumps along to the next group, pauses

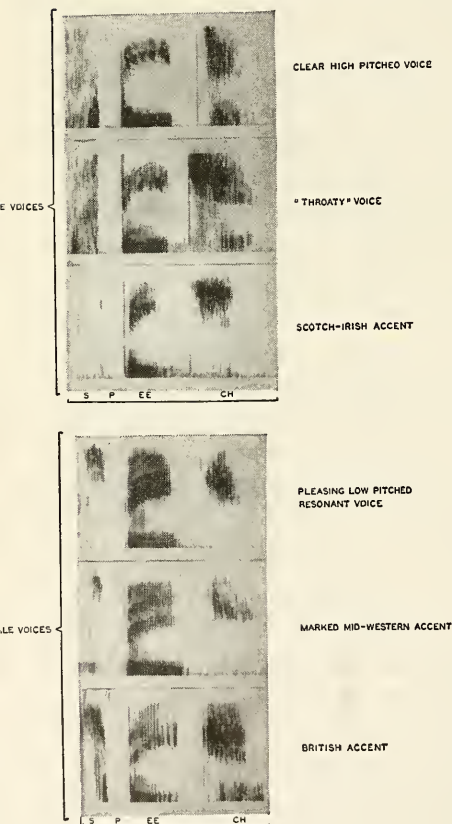


Fig. 5.28. Visible speech. A record is made on tape, in this case the word SPEECH; then the tape is run through a filter tuned to 70 cycles a second which drives a pen that traces, at the bottom of the record, the intensity and duration of the 70-cycle band of each speech sound. Then the tape is run through the analyzer again with the filter tuned to 90 cycles, making a mark a little higher on the record, then 110 cycles, and so on, up to 3500 cycles per second at the top of the record. Note that the sound pattern of CH consists mostly of high frequencies while EE includes both high and low but no middle frequencies. There is considerable uniformity among the six speakers in production of the vowel EE, but much variation in the consonants. (Courtesy Bell Telephone Laboratories)

there a moment, then jumps again, and so on. A fast reader will take in a whole line in two or three glances; a slow reader may need seven or eight. If the eyes are photographed as they hop along a line of type, the records show that 90 to 95 percent of the reading time is spent in *fixation* on a group of letters, while the other 5 to 10 percent is spent in jumping from one fixation point to another. You can see the eye movements if you punch a hole in a newspaper with a pencil, then hold it in front of someone and ask him to read the material near the hole while you watch his eyes from behind the paper. During the time that the eyes are jumping from one fixation point to the next, the reader perceives practically nothing. But, since this time is only 5 to 10 percent, it is a small waste, and it often is not a waste at all, because some time is required to grasp the meaning.

This activity, like walking down the street and most other activities, goes forward smoothly until an obstacle is encountered. If the walker is just taking a walk, one path is as good as another. And if the reader is just letting his eyes wander over the page, one word is as good as another. But if the reader is set to grasp the information the writer is trying to communicate, any interference with this communication is perceived as an obstacle. When this happens, the reader is likely to make backward or *regressive movements*. His eyes jump back to a group of words previously fixated, or he may jump back a few lines. If the number of regressive movements is large, the reader is wasting time.

Since reading is a complicated operation, its efficiency depends on a variety of conditions. Some of these are obvious; some have been discovered only recently by psychological experiments.

Type Size. The best type size depends on two principles. When the type is large, the reader can get only a word or two in one fixation. When the type is small, it approaches the threshold of visual acuity. The best type, therefore, is somewhere between these two limits, approximately the size of the type used in this book.

Type Pattern. The legibility of different words and letters can be compared by exposing them briefly and counting the readers' errors. It turns out that the length of the word and the letters extending above and below the line are important variables. There will be no confusion between "svelte" and "pea," but "lurk" may be read as "lark" or as "hurt." When single letters are compared, the best type styles are those in which distinguishing details are emphasized. **G** is more easily distinguished from **C** than **G** is. **Q** is more easily distinguished from **O** than **Q** is. These details are not important for ordinary reading matter where redundancy is high, but they are important in the design of dials, warning signs, and instrument markers, which often have only a few letters or numbers and are viewed under poor conditions.

Line Pattern. Arranging letters and words in a line across the page is customary in many languages, but there are other interesting possibilities. When the material is easy to read and the emphasis is on speed, the square pattern is better.⁸

This is	of the	style of
an example	square span	presentation.

Viewing Conditions. Efficient perception requires sharp contrast between the letter and the background. In general, black on white makes the best contrast. Weak illumination reduces this contrast. So does glare from a shiny background. Dull paint makes a better background for metal signs than does glossy paint. Dull paper is better than shiny paper. But many textbooks have to use hard paper that will take photographs, so here again a compromise between two principles is necessary. Fig. 5.29 shows road signs arranged for comparison under actual viewing conditions.

For best reading the general illumination in the room should be moderately strong and even, while the book or instrument to be read should be somewhat more brightly lighted. There should be no highlights or reflections from shiny objects in the field of view. The page or instrument panel should be perpendicular to the light of sight. Some television sets, kitchen ranges, speedometers, and dials have the letters and numbers at such an angle from the reader that errors of perception are common.

Spoken Words

From the speaker's standpoint a speech sound is a complex response. From the perceiver's standpoint it is a complex stimulus. The speech sounds are generated in the larynx and modified and interrupted by the tongue, teeth, palate, and lips. What comes out of the mouth is a burst of sound waves of various frequencies and intensities arranged in a temporal pattern. The frequencies of ordinary speech are mostly from 100 to 8000 cycles per second. Speech has evolved through many years of human interaction, so it is natural that speech frequencies fall in the range of best human hearing.

Speech sounds may go from the speaker directly to the listener, from near or from far, in a quiet room or in the midst of a noisy group. In recent years much communication takes place also by telephone, radio, tape recorder, and other electrical communication systems. When the control tower talks to the pilot coming in for a landing, when the desk sergeant talks to the policeman in a squad car, when the executive dictates into an office machine, and when a public announcement is made in a railway station or airport, the efficiency of the communication system is a matter of considerable practical importance. The listening conditions in many industrial and



Fig. 5.29. Road test signs.

military situations also are less than good. Hence communication engineers and experimental psychologists have worked out many of the variables that determine the accuracy of the perception of speech.

Frequency. The frequency or pitch of the voice is not very important. A word spoken by a soprano or by a bass can be heard equally well.

Speed. Speed of talking is not as important as one might expect. If the speaker talks at 100, 200, or 300 words a minute, the average listener can perceive the message quite well. On the other hand, if speech recorded at normal speed is played back at double speed, the familiar pattern of frequencies is distorted, and the listener gets very little. Playing it back at half speed is equally bad. If the record is speeded up or slowed down only 10 or 20 percent, the listener perceives most of it.⁹

Intensity. The intensity or pressure of the sound wave that reaches the ear is obviously an important variable. In a quiet room speech sounds of 20 decibels can be understood quite well. When the speech is above 80 decibels, efficiency of perception falls off slightly. See decibel chart on page 93. But many rooms are not quiet, and most communication systems, like telephones and radios, introduce noise of their own. The important condition is the *speech-to-noise* ratio, the intensity of the speech relative to the intensity of the background noise. This is something like contrast in perception of printed words. Turning up the volume control is useless if the noise intensity increases along with the speech intensity. In fact, turning down the intensity sometimes helps.

If the noise is different from the speech and comes from a different place, the perceiver has a relatively easy task. The worst background noise is made by voices near the speaker. A high speech-to-noise ratio is necessary under such conditions. But even when two voices have been recorded together on tape, people can learn to hear either one above the other.¹

Distortion. Most communication systems have to be light, inexpensive, and rugged. Except for high-fidelity recorders, they are not very accurate. Fortunately, mutilated speech, like mutilated type, can be perceived astonishingly well. The high frequencies of the sound pattern can be cut off, the low frequencies can be cut off, chunks of words can be sliced out, and, because of the redundancy of the language, perception is still fairly good.

Speech Training. The listener's task is sometimes made harder by the talker. But just as the writer can improve his typing and his handwriting if he works at it, the speaker can learn to speak loud without straining and to articulate precisely. If he is talking into a microphone, he can learn to handle it properly. An hour of such training improved perception of speech over an aircraft intercommunication system about 7 percent. Four hours of training doubled the improvement. In this practical problem the psychological approach, training the talker, was more effective than the engineering ap-

proach, improving the instrument.¹⁰ The speaker can help also by organizing his talk so that the listener can follow him and by emphasizing important points—just as the writer uses headings and italics. Under difficult conditions of communication the speaker should deliberately add redundancy.

The Set

Listening is not quite parallel to reading. The speaker goes at his own pace, and the listener has to follow. The reader, however, can choose his own pace, slowing down when necessary and even going backward. The listener cannot make regressive movements—though he may ask the speaker to do so. At any rate the listener's task is to listen selectively, and actively. Listen in an exploratory way at first to find out what the speaker is going to say and what part of it you want to hear. Once you have grasped the structure of the talk, you can usually skip much of it and concentrate more closely on the parts that are important to you.

The reader has more control over the communication process than the listener and should exercise this control deliberately. Skim through the material first to see what the writer is trying to communicate. Textbooks are usually well organized so you can get the plan by noting introductions, headings, italicized words, summaries, and the table of contents. With this frame of reference you can then read the details and fit them into the overall plan more accurately. If the material is not well organized, you may have to outline it as you go, and read it again for details. It is not wise to try to get all the details the first time through.

The second suggestion is to develop several different reading speeds and shift as necessary. When reading the fine print on a legal document, it is best to go slowly and scrutinize every "whereas" and "to wit" carefully. When reading a newspaper or a novel, the reader who pushes himself can usually speed up his progress without missing anything important.

INDIVIDUAL DIFFERENCES

Individuals differ in ability to perceive and in what they perceive. Perceptual abilities depend to some extent on sensory abilities, and thus they improve in general up to age 10 or 12 and decline in old age. If a perceptual task is one that requires speed, the older people are at a disadvantage. In jobs requiring steadiness and adherence to standards, as in inspecting, the greater experience of the older people is more valuable. They know what to look for and listen to.

Because perceptual skills are important in such a wide variety of jobs today, many tests have been devised to measure individual differences in various perceptual tasks. The task illustrated in Fig. 5.30, for example, re-

quires careful comparison of details. Anyone with good acuity can get such items right, but some are much faster than others, and tests of this kind are given with a short time limit, so they measure perceptual speed and control of attention. Fig. 5.31 illustrates the kind of problems that appear on tests of pattern formation or visualization of spatial relations. Fig. 5.32 requires visualization of a three-dimensional pattern, but there is no unique ability for three-dimensional perception and those who do well on tasks like Fig. 5.31 do well on tasks like Fig. 5.32. The reader who remembers the concept of embedding will understand why items like Fig. 5.33 are difficult. One has to hold onto the model while analyzing the other patterns. In Fig. 5.34 the designs are incomplete and the observer has to fill in the gaps and name the object perceived. Success depends on continuity and familiarity. As we shall see in Chapter 11, some of these perceptual tasks are included in intelligence tests.



Fig. 5.30. Which of the patterns on the right is exactly the same as the model?

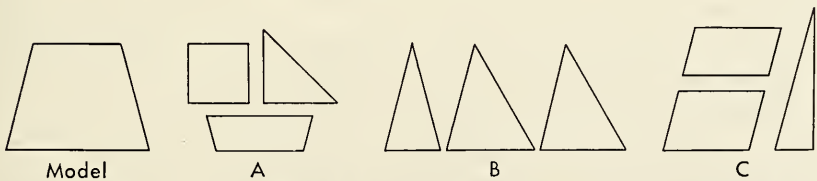


Fig. 5.31. Which group of parts, A, B, or C, can be put together to construct the model?

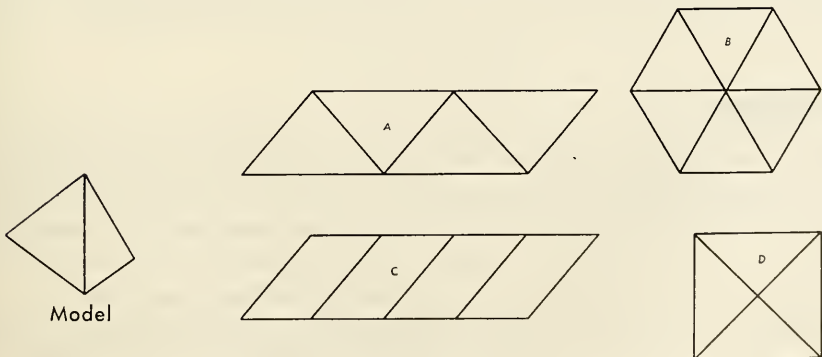


Fig. 5.32. The model is a solid object, and the figures at the right represent pieces of paper. Which one can be folded along the lines shown to form the model?

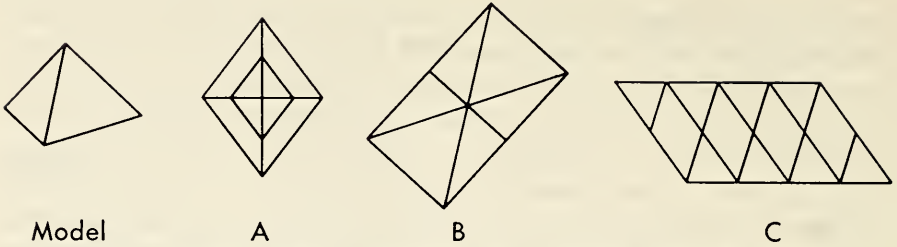


Fig. 5.33. The design at the left is included in one of the three at the right. Which one?

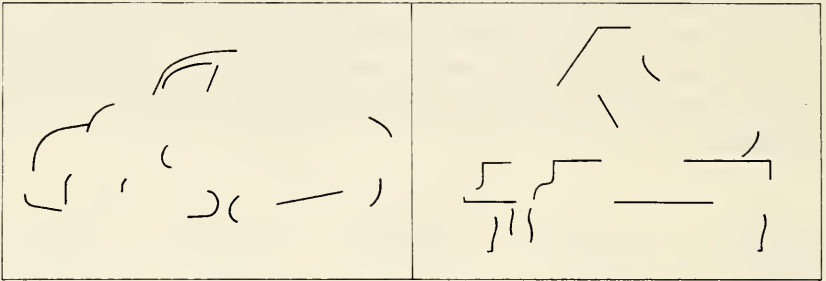


Fig. 5.34. Name these objects which the artist left unfinished.

Now the tests mentioned thus far have been invented in order to measure excellence of performance on some perceptual task. But since a principle of perception says that what one perceives depends not only on the stimulus situation but also on the perceiver's motivation, perceptual tests are useful in reverse for testing the perceiver's motivation. If we show a person an unclear picture of white boys and colored boys, arranged so that they could be fighting or they could be playing, and ask him what he sees, the answer will often reveal the person's attitudes toward relations between white boys and colored boys and what he permits himself to say about such matters. The Rorschach test, consisting of inkblots (see Fig. 5.15), some in colors, is used in a similar way to disclose the perceiver's attitude toward the world, his way of integrating what he sees, and his style of thought.

SUMMARY

Perception consists largely in forming patterns, such as the figure-ground pattern, out of the stimuli that reach the eyes, ears, and other sense organs. The factors that determine which patterns are perceived are stimulus factors, such as proximity, similarity, continuity, whole-part relations, and movement, and organismic factors, such as familiarity and set.

Objects beyond reach can be located, as to direction from the observer at least, by time differences and intensity differences in the sounds that

arrive at the two ears. Because of the position of the ears, location is best in the horizontal dimension. Visual location of objects in the horizontal and vertical dimensions is excellent because of the arrangement of the receptors and their nerve fibers in the retina. Perception of distance of objects is more indirect, depending on monocular cues, such as overlapping, shadows, relative size, and clarity, and binocular cues, such as convergence and retinal disparity. All of these cues are emphasized by movement of the head and by familiarity. The motion of moving objects is perceived according to the same principles, even if the object is seen only intermittently. These various kinds of information about objects in space do not always agree, but the perceiver integrates them somehow, vision being dominant over hearing, according to his set.

Words are visual or sound patterns of considerable redundancy, perception of which is influenced by such variables as familiarity, context, and set. These patterns vary from one writer or printer to another and from one speaker to another, but the perceiver learns to pick out the common patterns that communicate something and to ignore the individual peculiarities. The reader perceives a line of printed words by fixating vision on one group of words, then jumping to another group, and perhaps jumping backwards when he gets stuck. The efficiency of perception is determined by such factors as type size, type style, line pattern, and viewing conditions. The most important variables in oral communication are the speech-to-noise ratio and the articulation of the speaker. The listener has to go at the pace of the talker, but the reader can speed up and slow down according to the nature of the material.

Individual differences in perceptual abilities are tested by a variety of tests, the most abstract of which are included in tests of general intelligence. Most perceptual abilities improve up to age 10 or 12 and decline in later years. Perceptual speed declines with old age, but perceptual judgment holds up. When the stimulus material is ambiguous, perception is influenced by personal factors; and this principle can be used in reverse, to infer personal characteristics from test responses.

PRACTICE PROBLEMS

27. One device for improving the differentiation of controls, called "color coding," consists of painting different controls different colors. The Professor of Home Economics told the Professor of Engineering that color coding was more useful in the kitchen than in the factory and used two of the statements below to support her argument. Which two?
 - a. Kitchens are lighted better than factories.
 - b. Men are more mechanical than women.
 - c. Most kitchens are operated by women.
 - d. The number of women in factories is increasing.

- e. There is more automation in kitchens than in factories.
- f. Very few women are color blind.
28. The Professor of Engineering said that color coding is redundant. Was he right?
29. The Professor of Psychology said that it is because of the redundancy of perception that the world seems to be a stable place to walk around in. What did he mean by that?
 - a. Each retina has millions of interrelated nerve cells.
 - b. Information about objects in space comes to the observer in several different ways.
 - c. All perception occurs within a frame of reference.
 - d. The world is occupied by a variety of diversified objects.
30. Why are danger signals more often auditory than visual?
31. What is it about listening to a phonograph that corresponds to regressive movements in reading?
32. Stimulus is to frame of reference as word is to _____.
33. In ordinary reading the eyes jump rapidly from one group of words to another, but the words do not appear to move. Why not?
 - a. The reader is set to ignore motion and attend to meaning.
 - b. The words are fixated momentarily between jumps.
 - c. There is no vision while the eyes are moving.
 - d. The words are in a stable relation to the page.
34. In some sentences in a report of a psychological experiment S is perceived as an abbreviation for stimulus, in others as an abbreviation for subject. What makes the difference? (a) Familiarity; (b) fixation; (c) viewing conditions; (d) context.
35. Sometimes when a student perceives a misspelled word, he corrects it; at other times he ignores it. What makes the difference? (a) Set; (b) familiarity; (c) embedding; (d) overlapping.
36. The fact that man is a mobile animal is an argument for the claim that he has a general tendency to perceive (a) objects in space; (b) changing colors; (c) separations; (d) wavelengths.
37. Which term is different from the others: depth perception, perception of the third dimension, perception of movement, distance perception, perception of space?
38. In an experiment on auditory localization, plugging one ear with cotton would be (a) a dependent variable; (b) an independent variable; (c) a monaural cue; (d) a distracting stimulus.
39. The threshold for auditory localization is about three degrees when one is discriminating sounds in the (a) horizontal dimension; (b) vertical dimension; (c) right-left dimension; (d) front-back dimension.
40. Which of these distance cues is different from the others: interposition, shadows, relative size, convergence?
41. The use of shadows as a cue for distance perception depends on (a) discrimination of brightness differences; (b) visual acuity; (c) the threshold for cone vision; (d) retinal disparity.
42. The use of overlapping as a cue for distance perception depends on (a) convergence of the two eyes on a contour; (b) accurate perception of relative size; (c) relative motion of two objects; (d) pattern vision.
43. Can the signal-to-noise ratio be an independent variable?

44. Under what conditions would a test of speed of reading be a test of perceptual speed?
- When the material to be read is difficult.
 - When the material is easy.
 - When the material is unfamiliar.
 - When there are many regressive eye movements.

Discussion Questions

- How are attention and perception related?
- As a perceptual task, how does listening differ from reading?
- Analyze the task of driving an automobile as a perceptual task.

Recommended Reading

- S. H. Bartley. *Principles of Perception*. Harper, 1958. A systematic account for college students, covering the definition of perception, the contributions of each of the senses and the nervous system, and the integration of all these in the person's adjustment to his surrounds.
- J. J. Gibson. *Perception of the visual world*. Houghton Mifflin, 1950. An explanation of the perceptual activities involved in constructing a world of surfaces, planes, and distances that corresponds with the gradients of stimulation that meet the eye.
- D. E. Broadbent. *Perception and communication*. Pergamon, 1958. Summary and interpretation of recent research, mostly in England, on listening to two sources at once, listening for signals under monotonous conditions, and listening in noisy conditions. How much information can one perceive and act on under such conditions?



Information Services, Michigan State University

Chapter 6. PRINCIPLES OF LEARNING

Fifty years ago the neighborhood was chatting happily over the back fences about the new Stone baby, a passive armful of protoplasm, who lay calmly in his pink-lined crib asking nothing of this world but to be well fed and comfortable. Today that same organism is Mr. David L. Stone, a skilled jeweler and a fair poker player, who is proud of his family and his giant dahlias, wears bifocal glasses, votes as an independent, worries a little about his stomach, and dreams now and then of owning a helicopter. What happened in the intervening 50 years to produce such a comprehensive change? How do innocent babies, with potentialities for development in many different directions, actually become adults like Mr. Stone, Mrs. De Giacomo, and Miss Eisner?

Development of the individual from conception to maturity and on into old age is a very complex affair, and only part of it is due to learning. Much of the change in the individual as he grows older is due to maturation, as noted in Chapter 1. The part that we call *learning* is the persistent change in behavior produced by practice. We include the word "persistent" in order to exclude temporary changes in behavior due to sensory adaptation, fatigue, illness, and the like. We include the word "practice" in order to exclude changes in behavior due to maturation, which require little or no practice. Experimentally, psychologists differentiate maturation from learning by using practice or experience as an independent variable. If an activity appears at a certain age in the life span of the individual, with or without practice, maturation must be the reason. The changes in Mr. Stone's eyes that necessitate bifocals are due to maturation. But if the activity requires practice for its development, and does not occur when practice is prevented, it must be due to learning. There are many kinds of practice, so we have words like "memorizing," "drill," "study," "training," "experience," and "exercise," but they all involve some kind of activity which affects later activity. When all the requirements for this wonderfully adaptive process are

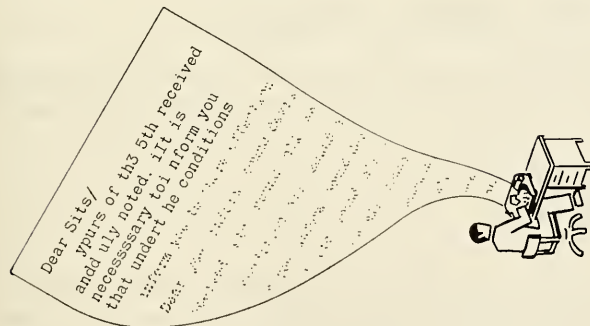
in order, learning is manifested in such civilized developments as repairing watches, playing poker, growing dahlias, reciting poetry, and worrying about foreign policy.

HOW THE LEARNING PROCESS IS ANALYZED

The design of an experiment on learning is quite simple in essence, though it may also be complicated in many ways. The first requirement is that the behavior under consideration be measured or at least recorded in some way. In the case of typing, the number of errors per page can be counted, or the time required for typing a page, or the number of words per minute. As a result of learning, these measures or scores may change in several respects. If a person is trying to learn, the responses he is trying to make, called "successes," usually increase in frequency, and "errors" usually decrease in frequency. Ordinarily speed is stepped up. Effort is reduced. If there is no good criterion of success and error, as when Mr. Stone's interest shifted from gardenias to dahlias, the various kinds of responses are counted, and changes in frequency of each kind show how the learning is proceeding. These are the principal dependent variables investigated in learning experiments. By definition, the principal independent variable is practice, but we shall see that others are also important.

Since learning is complicated, it is convenient to analyze the complete process into three phases, and to study these one at a time. The first phase of learning is the *acquisition* phase, during which new responses or changes in behavior are acquired. This phase is also called practice, or training, or original learning. In simplest form the sequence of an experiment on acquisition goes like this: first test, practice, final test (see Fig. 6.1). The score on the first test is recorded before practice begins. (Or perhaps one can assume that it would be zero.) After practice the subjects are tested on the same task and the same measures of performance are recorded. The difference between scores on Test 1 and Test 2 is the improvement due to practice. More practice and more tests can be given over a period of days or weeks to get a long record of progress, as in learning to drive a car. When the learner is practicing continuously in the psychology laboratory, no special tests are necessary for successes, and times can be recorded during each practice trial. By having people practice under different conditions the effects of these conditions on the amount of improvement can be investigated.

The second phase of the learning process is *retention*. It is not enough to know how new responses are acquired; we also want to know whether they are retained or forgotten. A retention experiment takes this sequence: practice, first test, retention interval, final test. The score on the final test is the



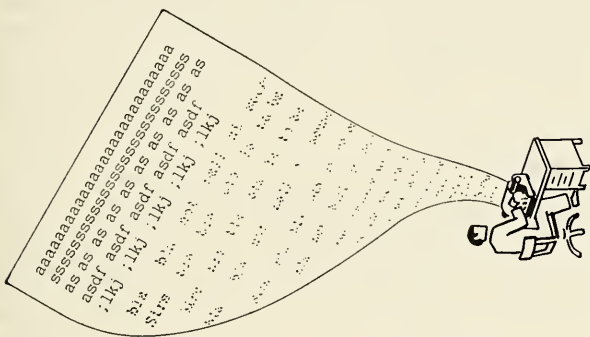
First Test

One letter of average length

15 minutes

12 errors

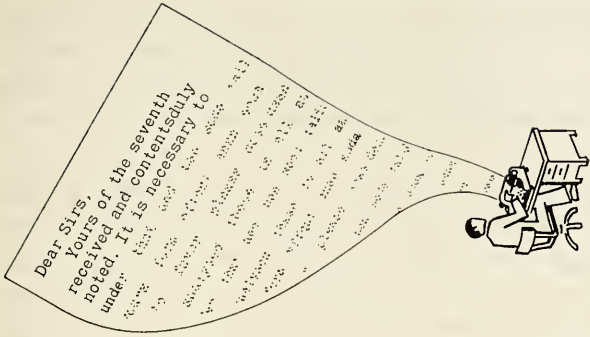
Four correct words per minute



Practice Period

A half-hour a day

for three weeks



Final Test

One letter of average length

5 minutes

3 errors

Twenty correct words per minute

Fig. 6.1. Analysis of learning. Learning, by definition, is the change due to practice or experience between the first test and the final test. A test is given and the subject's scores are recorded: amount done, errors, time, etc. Then he practices. Then he takes another test and his scores are recorded again. The difference between the last score and the first score is the amount learned. This is the basic method, but several variations are also described in this chapter. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

amount retained. The difference between the score on the first test and the score on the final test is the amount forgotten. Under ordinary conditions practice and forgetting go along at the same time, but when retention is under investigation in the laboratory, practice is forbidden during the retention interval.

The third and crucial phase of the complete learning process is performance on the final test. When the material that is learned consists of words, facts, pictures, and the like, the activity during the final test goes by such names as *remembering*, recall, and recognition. When the material that is learned consists of simple responses or skills, the final test may be merely the reproduction or reperformance of the originally acquired activity, time and errors being recorded. The main reason for studying learning, of course, is to understand how practice influences performance at a later time. The later performance depends, to be sure, on the original practice and retention, but it depends also on motivation, distraction, social influences, and other variables operating at the time of the later test, so we study these variables by giving the final test under a variety of conditions, holding acquisition and retention conditions constant.

The scientific reader will notice that this plan of analysis conforms to the classic method of experiment, which has proved so powerful in physics, chemistry, bacteriology, pharmacology, and agronomy. A complex process is broken down into a few phases; then while the other phases are held constant, one phase is isolated and studied by itself. We shall study these three phases of learning one by one, beginning with the initial learning period, in which new responses are acquired and taking up retention and remembering later.

ACQUISITION OF NEW RESPONSE PATTERNS

To study the acquisition phase we shall describe four types of learning and some acquisition curves, then show how several important conditions influence acquisition.

Types of Acquisition

Behavior is modified and new responses are acquired in several ways. Nature's rule is overlapping duplication rather than clear-cut departments. There are several ways of perceiving distance, several kinds of motivation, and, likewise, several types of learning, all of which make overlapping contributions to the life of the individual. In all of these the learner, whether he is trying to learn anything or not, is actively adjusting to the situation around him and in doing so he modifies his behavior. His activities have some feed-

back or consequence that influences later activities. To see how this can happen, different experimenters have designed different learning situations and have investigated the type of learning that occurs in each, thus emphasizing different concepts and principles of learning. There is no official classification of types of learning or situations in which new responses are acquired, but we can become reasonably well acquainted with the whole range of learning situations and the important concepts and principles that have come out of them by describing four well-recognized types.

Classical Conditioning. Remember that a reflex is a localized response to a stimulus: S-R. The examples given in Chapter 2, sneezing, coughing, blinking, are innate. They appear in the behavior of all people regardless of the conditions under which the people grow. Other reflexes are learned. These are acquired only under certain conditions of training, so they are called conditional or *conditioned* reflexes, and the training, a special kind of learning, is called *conditioning*. The classic experiments on conditioning were done 50 years ago by Ivan Pavlov, the great Russian physiologist, so we call this type *classical conditioning* to differentiate it from a newer type, to be described later.

Suppose we try to train a dog to salivate when a bell rings. This is certainly not an innate reflex, but the dog can acquire it by conditioning. The response of salivating, R, is produced innately by food in the mouth, so we call this stimulus the unconditioned stimulus, S_u . Now to develop a conditioned reflex we ring the bell just before we give the dog the food. The bell is the conditioned stimulus, S_c . In symbolic terms the sequence of events may be written, with some oversimplification: S_c-S_u-R . After this has been done several times a day for several days, we can skip the food and the R will appear without it. This is the conditional or conditioned reflex, S_c-R .

As another example, suppose we wish to teach our dog to lift his right front leg when a light appears. We can attach an electrode to his leg to give him a mild shock, the S_u . The conditioning sequence is to turn on the light, the S_c , then the shock, the S_u . The light should be where the animal is sure to see it and should precede the shock by about half a second. The animal will probably turn his head to observe the light, but we are usually not interested in this investigatory response. The response to the shock is usually a generalized response similar to the startle response described in Chapter 2, but the animal soon adapts to the situation and makes only a localized leg movement. After sufficient training we can leave out the S_u and the animal will lift his leg to the light alone (see Fig. 6.2).

Diagrams of conditioning, like Fig. 6.2, leave out the organism and simply try to show how one stimulus can be substituted for another or how a response gets associated with a new stimulus. From another point of view we can picture conditioning as an adjustment of the organism to a sequence of

stimuli. Perceiving S_c followed by S_u , the animal adjusts to S_c as a signal that S_u is coming.

The essence of the training is, of course, the shock, S_u . Building up the strength of the conditioned response by giving the S_u is called *reinforcement*. If the experiment is prolonged, S_c being given frequently without S_u , the

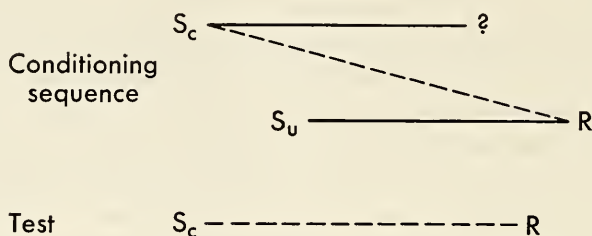


Fig. 6.2. Conditioning a withdrawal response to a light. The conditioning consists of presenting the light, S_c (the response to which is usually not recorded), followed immediately by the shock, S_u . The response following S_u is withdrawal but, because of the experimental arrangements, it follows S_c also, as shown by the broken line. After a few trials a day for a few days S_c is presented without S_u as a test of the progress of the conditioning. If R follows S_c , the conditional response has been established.

response to S_c will become weaker and may cease. This is known as *extinction*. The animal learns that S_c is no longer followed by S_u , so he stops responding to S_u or, in other words, he adjusts to this new turn of events. When the conditioned response has been extinguished in this way, it can easily be revived by a few reinforcements with S_u .

Emotional responses seem to be particularly susceptible to this kind of learning. Suppose our friend Mrs. De Giacomo is baking a cake when her youngest child crawls into the kitchen and spies the family cat. He reaches out to pet the cat. Now let us say that Mrs. De Giacomo lets the oven door slam, scaring the cat, her child, and herself and creating a general domestic disturbance. The sequence of events fits into the conditioning pattern, and two or three sequences like this may be enough, if the child is excitable, to establish a conditioned emotional response. If so, we can analyze the events as follows: The S_u is the noise, which elicited the emotional R . But it was preceded by S_c , the cat. If the situation is favorable, the conditioning takes place quickly and later the cat arouses an emotional response.

If someone who has been conditioned to make the GSR, the galvanic skin response of Chapter 2, to a tone of 2000 cycles per second hears a tone of 1000 cycles, he will still make the GSR, but it will be a weaker response. The response to a tone of 500 cycles will be even weaker.¹ This is known as *stimulus generalization*, and the principle states that anyone conditioned to one stimulus will respond to other similar stimuli with a somewhat weaker response. The reverse of stimulus generalization is *stimulus differentiation*.

The range of stimuli to which the response is made can be narrowed by differential training, that is, by reinforcement of response to some stimuli and no reinforcement of response to other stimuli. One might make a guess at this point that a response conditioned to a word would generalize to other words, and the next chapter will report some curious discoveries that confirm this guess.

Conditioning is a low-level kind of learning; human beings do not have to work hard at it, and they do not do it much better than the lower animals. When adult human beings are conditioned, the learning occurs in a social situation, and social influences are critical. It has been found, for example, that those people who acquire a conditioned eyeblink reflex most quickly are the ones who are most easily hypnotized.² The experimenter's instructions may increase or decrease the amount of conditioning, but if he can distract the subject's attention from the experiment, the conditioning goes more smoothly.³

Operant Conditioning. Recently psychologists have invented training sequences that are more complex than the classical conditioning of Pavlov but can still be listed under the heading of conditioning. Suppose we put a rat in a box containing only a lever with a tray under it, which is called a Skinner box after its inventor, B. F. Skinner (see Fig. 6.3). A rat is a curious animal; he will soon paw the lever and the tray. Automatic apparatus is arranged so that, when the rat presses the lever, a pellet of food rolls down into the tray. This is like putting a penny in a machine to get some gum, only our laboratory rat does not need a penny. He eats the food in the tray and, if he is hungry, soon presses the lever again. He gets another pellet of food, eats it, and presses the lever again. He has acquired a new response in this situation, lever pressing, or at least his rate of lever pressing has been greatly increased. Since the lever-pressing response is preparatory or instrumental to getting the food, this type of learning has been called instrumental conditioning. Since the response operates on the environment, it is also called *operant conditioning*.

In this procedure the experimenter does not use S_u to elicit the lever-

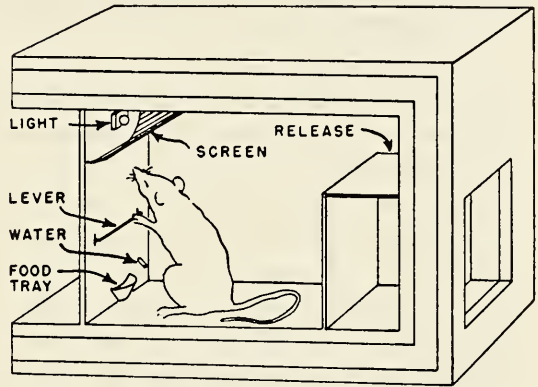


Fig. 6.3. Skinner box. When the animal presses the lever, a pellet of food is automatically delivered to the food tray—or a drop of water to the water tube. The reinforcement can also be presented intermittently or in association with the light. (From L. Postman & J. P. Egan, *Experimental psychology*, Harper, 1949)

pressing response. The lever is the only interesting thing in the box so the animal presses it whenever he is ready. Thus operant conditioning is more dependent on the animal's level of responsiveness than classical conditioning is. The reinforcement, which strengthens the lever pressing when it occurs, is of course the food. This sequence differs from classical conditioning

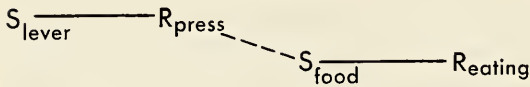


Fig. 6.4. Operant conditioning of a lever-pressing response. At first the lever pressing is an exploratory response to perception of the lever. When the lever is pressed, the experimental arrangements present the food, S_u , and the natural eating response follows. The first S-R is rewarded or reinforced by the second S-R. Since some exploratory responses occur at first, the test of learning is the increase in rate of response in this situation, e.g., the number of lever presses in five minutes.

in that the reinforcement occurs *after* the conditioned response (see Fig. 6.4). In classical conditioning the reinforcement elicits the response; in operant conditioning the reinforcement rewards the response. Or, recalling the distinction between instrumental and goal activity of Chapter 2, we

can say that the first S-R is part of the instrumental activity preparatory to the second S-R, which is the goal or consummatory activity. If the floor of the box is electrified, rats can learn to jump to a safe place or to turn off a switch or to perform other instrumental acts that get them out of trouble.

Classical conditioning works best when S_u follows S_c at an interval of a half-second or so. This sequence is easily arranged in the laboratory and occurs also in some situations outside the laboratory. Operant conditioning does not require such control over the interval between stimuli. It is the interval between the operant and S_u that must be short because S_u rewards and reinforces the operant. S_c , whatever it may be, is necessary only to elicit the response which the trainer wishes to reinforce. Operant or instrumental conditioning is a flexible procedure by which rats, chickens, pigeons, pigs, and college sophomores have been trained to perform a variety of tricks under the experimenter's control. The methods of animal trainers, tennis instructors, and ballet coaches are closer to operant conditioning than to the classical conditioning of Pavlov.

In these illustrations of conditioning the reinforcement has been an innate reflex, such as withdrawal from shock, or a goal response, such as eating. But if a light has been associated with a shock, the light itself acquires reinforcing properties and can be used to reinforce other learning. If your dog has been frequently fed after perceiving a certain stimulus, e.g., hearing a spoon scraping a dish, this stimulus also can be used to strengthen the learning of other acts. It is then called *secondary reinforcement*. Most learning of human beings is reinforced not by primary goal activity but by such secondary reinforcers as a kind word, a promise, or a scowl.

The operant conditioning technique can be used as a parlor trick or a classroom experiment to train a person to make a brief movement, like scratching his ear. The experimenter tells the subject of this little experiment that his job is to accumulate points. "Every time you make a point, I will tap my pencil on the desk. You make a mark on your paper to show that you made a point." After these instructions the experimenter watches and says nothing. Since the situation is unusual, the subject will be alert, perhaps anxious, and make various movements. College students in particular are eager to accumulate points. Usually the subject will put his hand to his ear sooner or later. The experimenter taps his pencil, and the subject gives himself a point. After a while he puts his hand to his ear again. Tap again. Another point. Soon he may be scratching his ear 8 or 10 times a minute.⁴ This is instrumental or operant conditioning with secondary reinforcement. The response is not new, of course; what is new is that it now occurs 10 times a minute and that the experimenter has some control over it.

This type of learning occurs in many social situations, especially those in which one person is sensitive to and is therefore reinforced by the approval of another. Experiments have shown that in such cases one person's instrumental acts are strengthened when the other makes gestures, such as a nod of the head or a smile, or sounds, such as "mmm-hmm" and "good," which are interpreted as signs of approval.⁵ Not only are simple acts required in this way but generalization at a rather abstract level has been demonstrated. For example, when someone is reinforced by "mmm-hmm" every time he says a plural noun, he increases his rate of production of responses of this class.⁶ If the subject knows what the experiment is all about, he may learn faster, but such awareness is not a necessity for this type of learning.⁷

A very interesting phenomenon that has turned up in research on conditioning is the effect of partial or *intermittent reinforcement* on extinction. Ordinarily, if an animal is reinforced with food every time he presses the lever in a Skinner box, he increases his rate of responding and then, when the reinforcement is turned off, his rate of responding declines and he may extinguish completely. If, however, he is given a pellet of food only every other time or every third time he presses the bar, he continues to respond at a high rate long after food has been withdrawn. One of Professor Skinner's pigeons pecked at a button 6000 times an hour even though it was reinforced only 12 times an hour.⁸ Apparently if the learner is reinforced every time while learning, he can quickly tell when the reinforcement is turned off, but when reinforcement is irregular, it is harder to detect the difference. Something like this happens to human beings also. When one person's actions are reinforced by another person, such reinforcement is seldom perfectly regular, so it is hard to detect when the reinforcement stops. A child

is not reinforced every time he calls his mother, but if he is reinforced at least occasionally, he keeps on trying. Pulling the lever of a slot machine is a response that is reinforced only intermittently, and this response seems to be particularly resistant to extinction. One of the advantages of the technique of operant conditioning is that it promises a way of studying how social situations with all their human inconsistency can shape human behavior into fairly regular patterns.

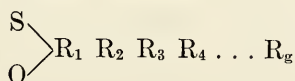
PRACTICE PROBLEMS

1. When someone says, "It's on the tip of my tongue, but I can't say it," the difficulty is in which phase of learning? (a) Acquisition; (b) retention; (c) recall.
2. A teacher compares the performance of students who practiced typing without looking at the keys with the performance of students who did look at the keys. This is an experiment on (a) acquisition; (b) retention; (c) reproduction.
3. At midterm the teacher has half the class type a letter in the classroom and the other half type it in a busy office. Average scores are compared. This is an experiment on (a) acquisition; (b) retention; (c) reproduction.
4. Which of these is necessary for all kinds of learning? (a) Practice; (b) generalization; (c) differentiation; (d) social interaction.
5. Young women in a social situation are often advised to "keep them guessing." This is analogous to (a) intermittent reinforcement; (b) classical conditioning; (c) stimulus generalization; (d) verbal conditioning.
6. If we wish to make Fig. 6.4 apply to operant conditioning of words in a social situation, we must assume that (a) the original stimulus for response is identifiable; (b) the experimenter's verbal reinforcement evokes a positive response in the subject; (c) the subject understands the nature of the experiment; (d) the subject is attending to S_u when S_c occurs.
7. From what you learned about motivation in Chapter 3 predict which subjects would learn fastest by instrumental conditioning in a social situation.⁹
 - a. Subjects of high intelligence.
 - b. Subjects who like to talk.
 - c. Anxious subjects.
 - d. Subjects with good vocabularies.
8. Operant conditioning will proceed faster when the reinforcement is given by which experimenter?¹⁰
 - a. "An attractive, soft-spoken, reserved, young lady who was 5'½" in height and 90 pounds in weight."
 - b. "A man who was very masculine, 6'5" tall, 220 pounds in weight, and had many of the characteristics which might be expected of a former Marine captain."
9. Extinction of a verbal response is most likely to occur when the response is followed by which action of the experimenter?⁶
 - a. Turning on a green light.
 - b. Turning on a red light.
 - c. Saying "mmm-hmm."
 - d. Saying "huh-uh."
10. Classical conditioning and operant conditioning are alike in which respect?
 - a. Sequence of events.

- b. Control of the conditioned stimulus.
- c. Irrelevance of awareness.
- d. Eliciting of the first response.

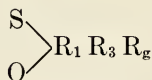
Selective Learning. In classical conditioning and operant conditioning the situation of the learner is deliberately kept simple—by mechanical arrangements for animal subjects and by instructions to human subjects. When the situation is more complicated, a third way of acquiring new response patterns can often be identified. In a complicated situation, if the learner is motivated toward some goal which he cannot reach immediately, his behavior can be separated, as in Chapter 2, into instrumental activity and goal activity. He varies his behavior, attending to one feature of the environment after another, trying one response after another. If he attains his goal by this indirect instrumental activity, he learns something in the process, and he does better next time. This is called *selective learning* because some of the various responses he makes are selected and reinforced by his activities in this situation. In classical conditioning the learner anticipates a certain stimulus and in operant conditioning he is limited to a certain response, but in selective learning he makes various responses to various stimuli. Thus this type is often called learning by trial and error. As in the other forms of learning the reinforcement of activities lies in the feedback or consequences of the activities.

As an example, consider the behavior of our friend Mr. Stone the first night he gets into his new automobile and looks for the headlight switch (see Fig. 6.5). He pulls, pushes, and turns things that seem movable, and finally the light goes on. The next night he makes fewer useless responses, and after a little more practice he makes the correct response without any error.



The above diagram helps to show the essential events on the first trial. The motivation raises the activity level and the organism makes one R , then another R , then another R , and so on. Some of these responses may be innate, some may be conditioned reflexes or habits learned previously, and some may be just random movements. If all goes well, one response will be the correct one, the goal response or R_g . When the learner's efforts are rewarded in this way, his goal-directed activities cease; he loses interest in the situation and turns his attention elsewhere. It is a general principle of this kind of learning, called the *law of effect* by E. L. Thorndike, who first stated it, that responses followed by rewarding effects are strengthened and repeated on later occasions. The other responses, not followed by such consequences, are weakened, or at least not strengthened. We do not know exactly why such

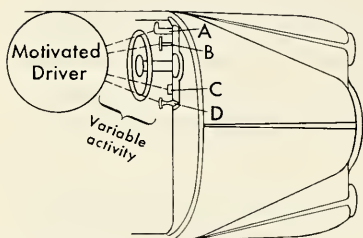
effects occur, but there is no doubt that the consequences of an act are important. Hence on the next trial some of these responses will not occur and others will occur sooner.



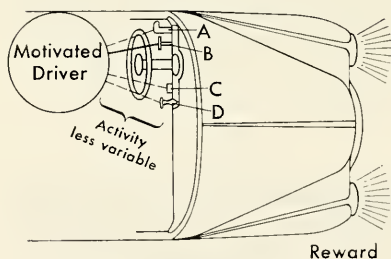
After more practice the goal response will be stronger than any other, so learning is complete and the diagram looks like this:



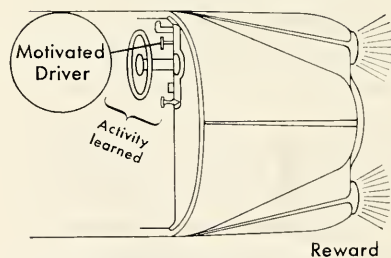
Learning to type can be taken as another illustration of this kind of acquisition of habits. When Mr. Stone decided to learn to type, he got a typewriter and went to work. Starting to write *Stone* he hunted over the keyboard for *s*, scraping the *d* on the way. Then he looked this way and that for



When he is motivated to turn on the lights in his new car, the driver tries everything he sees. He lifts handle A, pulls rod B, pushes button C, and turns lever D.



But the only one of these acts which is rewarded is pulling rod B, which turns on the lights. So, on the next occasion, the tendency to pull rod B will be greater, while the tendency to do any of the other things will be less. Activity becomes less variable, more predictable.



With a little practice the other acts are eliminated completely, and B is pulled every time.

Fig. 6.5. Selective learning. (From Donald Johanson, *Essentials of psychology*, McGraw-Hill, 1948)

the *t*. His brow was wrinkled, and he mumbled to himself. He worked hard. When he saw what he had written, he grunted, and tried to find something to punch to make a capital *S*. In the first few days of practice his movements varied considerably, but gradually many of the irrelevant activities and errors dropped out, while his speed and accuracy increased.

In both of these cases of selective learning we see the importance of flexibility or variation of activity. If Mr. Stone had made only one or two movements, he probably would not have made the correct movements. Simple conditioning situations are designed to prohibit variation of activity, but in complex situations the learner varies his responses and these are selectively reinforced.

Another characteristic of selective learning in complex situations is that a large part of the learning, especially at first, is *negative adaptation*—learning what not to do. Mr. Stone's scowls, grunts, and irrelevant movements are not rewarded, and they gradually decrease. Attempts to move things that are immovable are not followed by reinforcing feedback, and these too are eliminated. In the diagram above, R_2 and R_4 extinguished first, R_1 and R_3 later. In many situations the first part of the learning, a prerequisite for all other learning, is extinction of emotional responses.

Selective learning involves attention and perception as well as action. We know, from previous chapters, that when an individual enters a new situation, some things in the situation will be more attractive perceptually than others. Bright lights, loud noises, figures that contrast sharply with their backgrounds, and moving objects attract attention. Previous experience makes some objects look different from others. Even at first a new situation is not a homogeneous collection of stimuli; some objects, like the lever in a Skinner box, appear more interesting than others. As practice continues, the attention value of many of these objects extinguishes while others become more prominent. What looked like a movable object may be only a shadow, and the consequences of trying to press a shadow are not reinforcing. Thus, after preliminary exploration and manipulation one ignores much of the perceived environment and attends to those objects that have had reinforcing associations. One watches for objects that are cues or pointers to the goal object.

The reinforcement of selective learning is related in some way to the learner's motivation. Reflexes and emotions seem to be the basis for conditioning—for classical conditioning at least—but selective learning covers a longer span of time and involves the goal-directed preparatory activities described in previous chapters as well as the final reflex or goal response. The behavior of the lower animals is oriented at various times toward such goals as food, water, and the opposite sex, and they learn complicated paths to

these goals. A higher organism like Mr. David Stone may be set to turn on the car lights or to type words on paper for many different motives. We need not inquire where he is going or why he is writing. The important condition is the orientation toward a goal. If someone is set to see the lights shine, a response followed by this "effect" will be reinforced. The reinforcing effect of a response depends on its relation to the learner's ongoing activity, whether it is a simple reflex, as in conditioning, or a larger sequence of instrumental activities, as in selective learning.

Cognitive Organization. All learning involves organization, but conditioning, operant conditioning, and selective learning emphasize the organization of responses and behavior changes due to the strengthening of some responses and the weakening of others. Behavior may change also because the learner acquires new knowledge of the situation or organizes his knowledge in a different way. In addition to "knowledge" we often hear such terms as "cognition," "understanding," and "insight," which have about the same meaning, and "cognition" has a useful adjective, "cognitive." Knowledge comes of course from perception of the situation or from previous learning and remembering, so learning by cognitive organization is a process of manipulating and rearranging the data of perception or memory. In any case knowledge is organized; it consists of relationships, patterns, or structures. We know where an object is in relation to other objects, within a frame of reference. We know what a fish is in relation to other animals, within a zoological system. Some of the principles of cognitive organization are similar to the principles of perceptual organization, given in Chapter 5, but they apply also to abstract knowledge, such as knowledge of good and evil, and prime numbers, and the properties of the halogen series.

Learning by doing is an active outgoing way to learn. Cognitive learning is more sedentary, more intellectual. In the one the learner varies his responses; in the other he varies his way of viewing the situation. Hence cognition, like perception, cannot be directly observed. We observe someone's responses and from these we infer his cognition. Or we can ask him to describe the object of discussion, to define it, or to show its relation to other things. His responses may be arranged as words, sentences, signs, maps, and other symbols or representations of his cognition. Most school learning is cognitive organization and reorganization, and teachers try to write examination questions so that they can infer the student's knowledge from little black marks on paper.

For an example of this kind of learning look at Fig. 6.6, in which the task is to begin at the left and learn the trail to the hilltop. The correct trail is all in sight, but so are five other trails; hence the learner has to organize what he sees and make the hilltop trail stand out from its entanglements, as the lake

trail does. The chief organizing principle is of course continuity, but some practice is necessary before the continuous pattern is perceived.

Another illustration of learning by cognitive organization is furnished by the foreigner who comes to the United States and goes to a football game. At first the activities on the field appear completely unorganized. Young men in

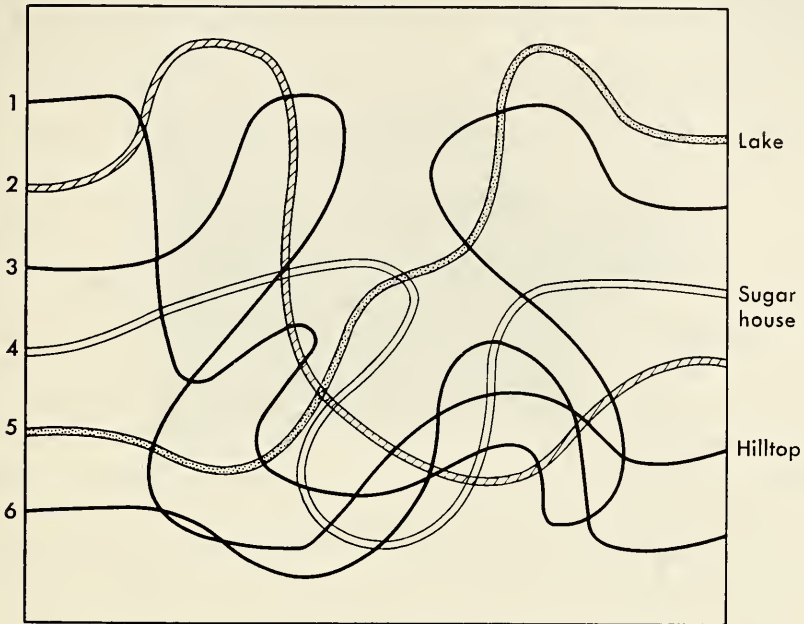


Fig. 6.6. Perceptual learning. Which trail leads to the hilltop?

carnival costume hurl themselves forward, backward, and sideward, then suddenly they all stop and walk leisurely back and forth. Whistles blow from time to time, the crowd yells, and the proceedings make no sense at all. But, as he watches the game, he may begin to see a pattern in it all. Each burst of activity has a beginning and an end, which are related somehow to the movement of the ball. The general outlines of the play become clear to him after a while; then he notices additional details, like the gestures of the men in zebra suits and the location of the linesmen and their markers. If he goes to another game—as he probably will—he may be able to organize all the parts into an understandable whole. An American trying to understand the games played in some other culture has the same task of organizing what he sees.

Selective learning and cognitive organization usually go together in any complex human enterprise. Consider Mr. Stone's progress, after he moves to the suburbs and has to learn the shortest route from White Rock Heights to

his jewelry store downtown. He will not take every road he sees. He has some knowledge, vague though it may be, of the relationship between his home and the store, so he tries only those roads which seem to lead in the right direction. He not only goes somewhere, he sees where he is going. In fact, since our Mr. Stone is not a man to waste time or gas, he will probably pick up a map at the filling station and learn something from it. The more he learns about the lay of the land by studying the map, the less he has to learn by trial and error. And, in reverse, as he explores the roads, he constructs his own cognitive map and makes less use of the paper map. His knowledge comes from his activities selectively reinforced, and later his activities are guided by his knowledge.

As an illustration of cognitive organization and reorganization at an abstract level consider the boy who groups goldfish, trout, sharks, whales, and seals in one class as fish, and cows, dogs, horses, chickens, and lambs as animals. He may later reorganize these in different groups, putting the chickens, cows, lambs, trout, and whales together as edible and grouping horses, dogs, seals, and sharks as inedible. Later in school he reorganizes them again, classifying the shark and trout together as fish, the whales, seals, cows, and lambs as mammals, and so on.

Organization has the same meaning in this chapter as in Chapter 5, where we noted in passing that perceptual organization is influenced by the familiarity that comes from previous practice. Figs. 5.11 and 5.12 illustrate how movement provides practice in perceiving an object from different points of view, against different backgrounds. What is practiced is not so much an association between S and R as between S and S. More precisely, one practices combining stimuli into patterns, breaking up stimulus patterns and reorganizing them into other patterns, and perceiving stimulus objects against different backgrounds.

Acquisition of Skill

After a person has learned some S-R associations, he often learns, at work or play, to put these together in a continuous skilled performance. Skating, writing, typing, and playing the piano are performances in which, as skill is acquired, there is a tremendous change in speed and accuracy of the responses. In the laboratory, where some of these skills have been practiced under controlled conditions, a favorite task is pursuit learning, as on the apparatus shown in Fig. 6.7. The target that the subject pursues revolves continually and the subject must continually watch his movements and correct them for errors just as he follows turns in the road when driving a car and adjusts his movements to those of his partner when dancing. A common verbal skill is memorizing or rote learning, the acquisition of words, dates,

definitions, songs, or poems for recall later on demand. Simple numerical skills, like saying 3×4 is 12, probably fall in the same class. No single act or item is difficult, but putting many of them together in a smooth performance takes practice.

Most of these are serial performances such that the first R can act as an S for the second R, and this R can in turn act as an S for the third R, and so on.

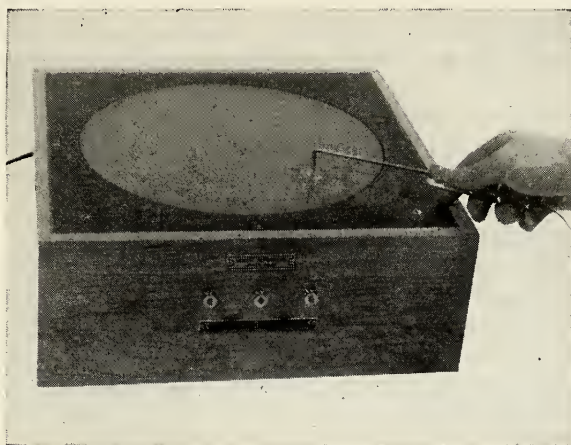


Fig. 6.7. Pursuit rotor. The subject's task is to hold the stylus on the small target while the disk rotates, e.g., 30, 60, or 90 revolutions per minute. An electric current flowing through the stylus and the target runs an electric clock which records time on target. (Courtesy Lafayette Instrument Co.)

Some of the separate acts may have been acquired at first by selective learning or even by cognitive organization, but henceforth the improvement in performance is not due to an increase in knowledge but can more reasonably be considered as the chaining together of conditioned responses into a smoothly functioning sequence. Hence such principles as generalization, differentiation, and negative adaptation are helpful in analyzing this kind of learning. These skills are practiced for a variety of motives—competition, self-defense, and aesthetic delight—and the learner may be oriented toward speed or accuracy, or he may compromise between these two. Perception of a neatly typed letter is rewarding, while stumbling over one's feet or over a word is distressing, whatever the original motivation for practicing.

PRACTICE PROBLEMS

11. After a cow stings her nose on an electric fence a few times, she avoids contact with wire fences. This is an example of (a) classical conditioning; (b) operant conditioning; (c) selective learning; (d) cognitive organization.
12. E. L. Thorndike, the famous psychologist, once put a cat in a box with a latch on the door. The cat pawed and bit and pushed on everything in the box and gradually learned to open the door. What kind of learning was this?

13. Which would be the best example of stimulus generalization applied to the case of Mrs. De Giacomo's child frightened by the cat?
 - a. The child gives a weaker emotional response the next time the cat enters the room.
 - b. The child learns to inhibit his emotional response to such stimuli.
 - c. The child gives an emotional response when the neighbor's dog enters the room.
14. In one conditioning experiment the subject kept a roll of gauze bandage in his mouth while the experimenter flashed a word on a screen in front of him, then gave him candy.⁹ How could the conditioned response be measured?
15. A psychologist held a conversation with a young man, smiling when and only when he ventured an expression of opinion. Soon the young man was expressing his opinions about everything.¹¹ What kind of learning is this?
16. Which is the best example of cognitive organization?
 - a. Learning the bones of the body.
 - b. Memorizing square roots.
 - c. Learning to speak a foreign language.
 - d. Learning telephone numbers.
 - e. Learning to catalog books in a library.
17. If Mr. Stone learned to turn on the lights (see Fig. 6.5) by cognitive organization, he would (a) try all rods, buttons, and switches in systematic order; (b) look under the instrument panel at the wiring; (c) get out and look at the lights; (d) vary his activity and observe the consequences.
18. We can claim that classical conditioning involves cognitive organization if we assume that (a) the subject is attending to the R ; (b) the subject perceives S_c as a signal for S_u ; (c) the subject is alert to changes in the situation; (d) S_c always precedes S_u .
19. Cognitive organization can be considered a kind of selective learning if we assume that (a) some of what the subject knows is wrong; (b) the subject is motivated to organize his information; (c) the learning involves words; (d) organizing is a kind of practice.
20. Operant conditioning could be considered a kind of selective learning except that in operant conditioning (a) the stimulus that elicits the response is not well specified; (b) the subject must be motivated; (c) the response is much less variable; (d) the reinforcement follows the response.
21. A psychologist telephoned 10 people and asked about their attitudes toward general education. When they gave replies that were favorable to general education, he said "Good." He telephoned 10 others and said "Good" when they gave unfavorable replies. In this way he got the first 10 to say favorable things and the second 10 to say unfavorable things about the topic.¹²
 - a. What kind of learning is this?
 - b. What is the function of the word "Good"?
22. Instead of classifying learning in four types we might speak of only two: simple and complex. Which types would belong under these two headings?

Acquisition Curves

Mr. Stone's progress in typing, as measured in number of correct words per minute, is shown in Fig. 6.8. We could also chart his progress in terms of errors or time for a standard letter, and by these measures progress would be

indicated by a downward trend. In a simpler situation, such as a dog in a harness being conditioned to lift his right rear leg to a bell, acquisition is measured by the speed of the conditioned response, or its magnitude, or the frequency with which it follows the S_c. Fig. 6.9, for example, shows how, in

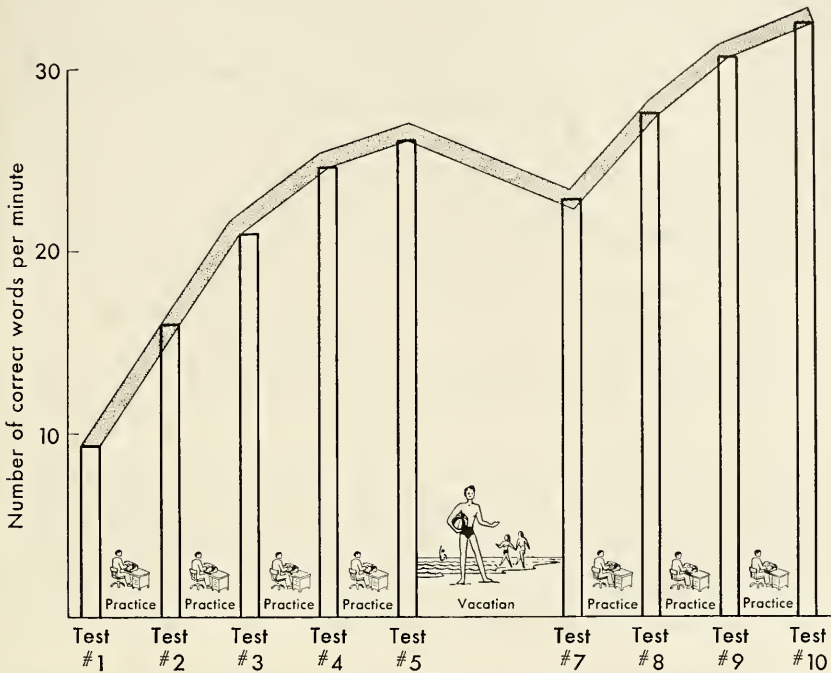


Fig. 6.8. An acquisition curve. Showing how Mr. Stone's typing improved with practice. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

one experiment, the frequency of the conditioned response increased to almost 100 percent over 20 test periods covering several months.¹³ During this time the animals gradually learned not to raise the other legs, though these curves of negative adaptation or extinction did not actually reach zero.

Both these acquisition curves show rapid progress at first, then more gradual progress. Toward the end of each graph the curve is still rising but the rate of rise has decreased, so this decrease in rate of improvement is called *negative acceleration*. The opposite would be *positive acceleration*—slow learning at first, followed by an increase in rate of improvement. Most learning curves show negative acceleration, usually because they are approaching a limit of some kind. This limit may be the individual's capacity for speed or accuracy, often called his *physiological limit*. In any case it is easier to reduce errors from 50 percent to 40 percent than from 10 percent to zero, and it is easier to reduce the time of an operation from 60 seconds to 50 than from 20 seconds to 10. When the material to be acquired is complicated, negative acceleration may be due to learning the easy things first; learning

slows down when only the hard parts of the task are left. If the task is one in which the hard things are learned first, after which the rest comes easy, we are likely to see a curve of positive acceleration. In learning to knit, for example, one may struggle along for days making slow headway, then catch

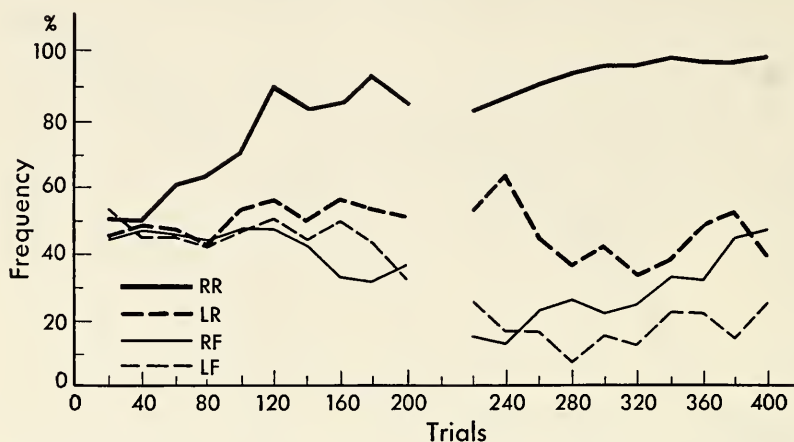


Fig. 6.9. Conditioning and general activity. The dogs were supported in a harness which allowed flexion movements of all four feet and, when the buzzer first sounded, all four were equally active. As conditioning proceeded, the right rear foot, which was the one being shocked, increased in frequency of response to the S_c up to about 90 percent. When test trials were resumed, after a break of 2 to 4 months, the right rear foot responded almost all the time while the foot farthest away, the left front foot, responded on only about 20 percent of the trials. (From Wolf and Kellogg¹³)

on to a trick that accelerates progress sharply. Positive acceleration is sometimes seen when one tackles a new task because some time is spent in merely adjusting to the situation and only later does any improvement begin to show. All these possibilities are complicated by fluctuations in motivation, making practice more efficient or less. In Fig. 6.8 we see that during vacation Mr. Stone did not bother to practice typing at all and on the next test his speed had fallen down. But after the vacation he began work more seriously, and his progress accelerated. Very few people approach the limits of their capacity. More often learning slows down because the learner is satisfied with his achievement.

When we observe a performance carefully, we often see different kinds of progress and can plot different acquisition curves. Typically a response is organismic at first, then more mechanical, as in Fig. 6.9. When Mr. Stone was first learning to drive a car, he had to pay attention and think what he was doing. Later, he performed the same movements mechanically, while he was waving to his wife, lighting his cigar, and worrying about being late to the office. The most dramatic evidence for this change in work methods

comes from observations of children at their homework. When children in Grade IIIA did arithmetic problems, such as 6×3 , some of them had learned their multiplication tables so thoroughly that 40 percent of the answers came automatically, without deliberation. But others had to think about the problems, reversing 6×3 to make it look like 3×6 , or working 5×3 and adding 3 more. And some just guessed. The children in the upper grades, who had had more practice, used less guesswork, needed less thought. As Fig. 6.10 charts their progress, in the upper half of the fifth grade 88 percent of the answers came automatically, through sheer habit.¹⁴ (Not all of this improvement is due to practice, of course, for intellectual maturation between Grades III and V is responsible for some of the change in work methods.)

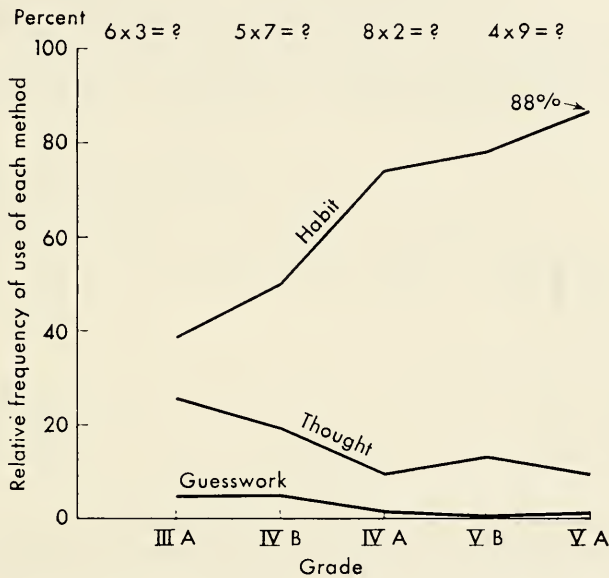


Fig. 6.10. Learning arithmetic. As children practice their multiplication tables, the percentage of answers reached by guesswork declines, the amount of thinking also declines, and the percentage of answers obtained mechanically, by habit, increases. (Data from Brownell¹⁴)

Principal Conditions of Acquisition

Now that we know some of the situations in which new behavior is acquired, the next question is about the conditions that improve and retard learning. Learning is a natural activity and obviously anything that improves the overall efficiency of the organism, like a good night's sleep when one is tired, improves learning as well. Beyond this general principle many experiments

have given us some more specific principles that are helpful to anyone who has a lot of material to acquire.

Practice. All kinds of learning require practice, but not the same kind of practice. In the case of conditioning it is only necessary that the organism be alert and responsive to changes in the situation. In other learning situations not much is acquired unless the learner is actively set to accomplish the task. In the classroom, listening to a lecture, for example, a general condition of alertness is not enough; the student who does something to the lecture material—organizes it, criticizes it, reinterprets it, or what not—acquires a larger percentage of it than the student who just listens. When the material is to be learned by reading and reciting, as in the case of a foreign language or a history lesson, it is efficient to start reciting as soon as possible.

In general, spaced or *distributed practice* is more effective than *massed practice*. Four hours' study the day before an examination is certainly better than no study at all but not as good as one hour a day for four days. This rule holds also for the learning of skills¹⁵ (see Fig. 6.11). Laboratory practice on

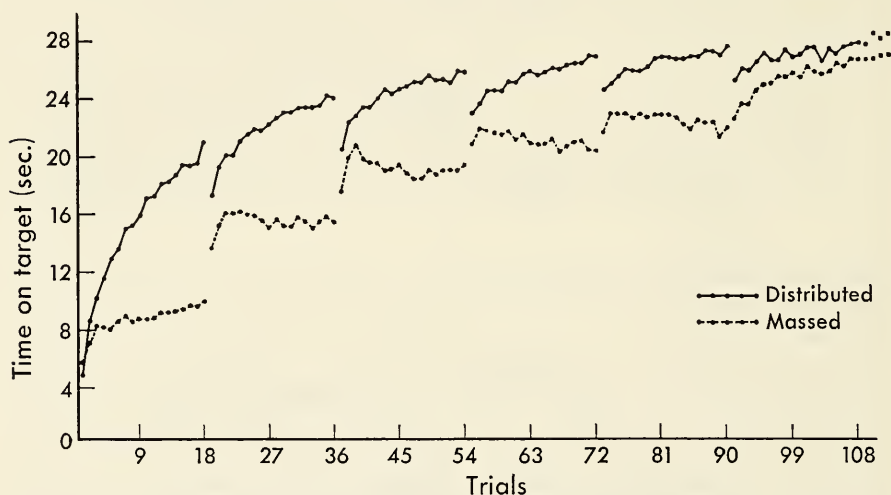


Fig. 6.11. Learning a motor skill by distributed and massed practice. Each group of subjects had eighteen 30-second trials a day, six days in all, on a pursuit rotor like that shown in Fig. 6.7. The distributed-practice group had a rest of 1.5 minutes between trials. The massed-practice group had only two seconds between trials and they were considerably less accurate than the other group until the last day, when they also were allowed 1.5-minute rests. (From Digman¹⁵)

motor skills has shown that practice in 5 separate 10-minute periods, even if they are separated by only a minute, is better than practice in one 50-minute period. The reason is not clear. Massed practice is more boring than distributed practice on these simple tasks and, in addition, any activity may build up its own interference or negative learning that extinguishes only during a rest period. Complex learning is not so boring and the learner's activities are too variable for interferences to develop; as a matter of fact, the learner

needs some time even to get started on a complex performance, like writing a term paper or playing chess. He may have to make a preliminary adjustment to the situation before practicing even one movement. If he is interrupted too soon, he will have to repeat these preliminaries.

Is it easier to learn a poem as a whole or by parts? Can one learn tennis better by practicing the separate movements or by starting right in to play the game? Many laboratory experiments have been directed toward this whole-part question, but the answer is not as simple as the question. Practicing the whole poem or the whole performance is best if the whole is small enough for one to grasp and realize some progress before getting bored. If the task is a long one, it can be broken up in parts, and mastery of each part can be a subgoal. But when the parts are practiced separately, the whole thing should be attempted occasionally so one can see how it all fits together and can identify troublesome parts for special practice.

In general, practice is a necessary but not a sufficient condition for learning. In simple conditioning situations a practice trial means that the organism has an opportunity to associate an S_c with an S_u or with an R , including an inhibitory R . In more complicated situations practice permits the individual to sample the many stimuli that he can perceive and to try out the many responses that he is capable of, including negative responses, such as ignoring and inhibiting. For the higher organisms like man practice is an opportunity to study the situation and try to organize the pertinent parts of it into an understandable whole.

Motivation. If we consider first the general level of activity, regardless of direction, there is plenty of evidence in all types of learning situations that people learn better when they are alert. Nevertheless many people have believed, or at least have hoped, that they could acquire useful information painlessly while sleeping—perhaps by keeping a Spanish book under the pillow or playing a record at bedside. But a recent experiment should put an end to this age-old dream.¹⁶ Twenty-one young men slept in a laboratory with electrodes attached to their heads so that drowsiness and sleep could be detected by their electroencephalographs. In the EEG records *O* means that the subject is awake and shows the usual pattern of wakefulness. *A+*, *A*, and *A-* are increasing degrees of drowsiness. *B* refers to a dreamlike state in which the EEG shows the beginnings of the sleep pattern and the subject does not respond to mild stimulation. *C* is light sleep. *D* is deep sleep, from which the subject is not easily aroused. *E* is very deep sleep. Information was given to these subjects by a tape recorder while they were in these various positions on the continuum from awake to sleep. Then they were awakened and tested on the material. As Fig. 6.12 shows, they learned very well while awake, and progressively less when drowsy. At the level of beginning sleep and light sleep they learned practically nothing.

Working in the other direction, we know that a drowsy person's learning can often be improved by cool air, or a cup of coffee, or anything that increases activity level. One can go too far, however. Fig. 2.6 shows that above a certain optimum further activation actually reduces speed of reaction,

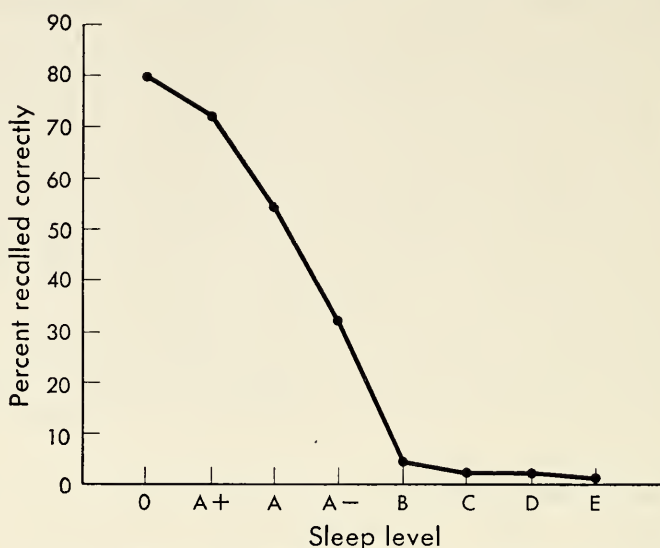


Fig. 6.12. Sleep and learning. As determined from EEG records O is the usual waking condition, and A+, A, and A- are increasing degrees of drowsiness. When sleep begins, at B, amount learned is practically zero. (After Simon & Emmons¹⁶)

and the same principle holds for learning. Anxiety also raises activity level, so subjects of high anxiety acquire a conditional eyelid reflex faster than subjects of low anxiety, but if the task requires selective learning of difficult material, anxiety reduces rate of learning.

In addition to the increase in general activity many motives have more specific effects. Something in the situation, often social, orients the learner toward or away from certain objects and prepares or inhibits certain activities. Chapters 2 and 3 described how motivational concepts like reflex, emotion, drive, and set help us understand the performance of certain activities, but the question for this chapter is whether these concepts help us understand learning. That is, these dynamic concepts account for practice but do they account for changes resulting from practice? The answer in general is that the reinforcement of behavior is always related in some way to the motivation of behavior, though the details of this relationship are not entirely clear. We have seen how the responses that occur in classical and instrumental conditioning are reinforced by getting food and avoiding shock. If we analyze a biological drive into instrumental activity and goal or consummatory activity, and the physiological consequences of the consummatory

activity, it appears that any part of this dynamic pattern can reinforce preceding activities. We know that instrumental activity is sufficient because the preparatory sexual approaches of the naïve young male rat to the female strengthens preceding activity even though the final consummatory response does not occur.¹⁷ The goal activity can be rewarding by itself also, because rats can be reinforced by drinking water sweetened by saccharin, which has no significant physiological consequences,¹⁸ and by eating food which is bypassed through a fistula before it reaches the stomach.¹⁹ The physiological consequences are also reinforcing because sucrose injected into the veins of rabbits strengthens learning even without the consummatory eating activity.²⁰

The different phases of the organism's motivation are no doubt integrated in the brain and even these central components can be separately investigated by ingenious techniques of brain stimulation. It is possible, for example, to implant fine wires permanently in a cat's brain in the area that produces a negative emotional response when a weak electric current is introduced. Then, if the cat manipulates a wheel that turns off the current, this act is reinforced by the cessation of the current. Furthermore, if the brain current is preceded by a flickering light, the cat builds up a conditional response to the light and turns the wheel before the current is turned on.²¹ Electric current delivered through electrodes implanted in other areas of the brain has positive reinforcing properties. In this experiment a lever is wired up to the current source so that when the rat presses the lever, he turns on the current that runs into his brain. Electric current in this location has positive effects and he presses the lever again. He gets another electrical kick, and presses the lever again, and again. Rats seem to enjoy this and they respond with high rates.²² Evidently motivation is a complex function of the organism, and several phases of the organism's activity can reinforce behavior, though future research will probably show that some parts of this mechanism are more important than others.

All the motives discussed in Chapter 2 can reinforce selective learning. More than that, Chapter 3 showed how new motives and new rewards are learned, and these in turn can reinforce learning. When parents and teachers try to motivate the learning of children, it is these secondary rewards that they use as incentives. When people try to motivate their own learning, the ultimate goals being remote or indefinite, they often set definite intermediate goals for themselves and if they reach these the preceding activity is reinforced. It is astonishing how much people will learn to get a lifesaving certificate, or a merit badge, or a college degree. To the average adult the world is full of positive and negative reinforcers, often abstract and artificial, but usually related in some way to his motives, interests, and values.

Punishment is a complicated event that has complicated consequences.

It is true that punishment inhibits activities that lead to punishment, but does it promote learning? In many cases that have been investigated the punishment inhibits the behavior temporarily, but when the punishment, or threat of punishment, ceases, the behavior returns. Punishment also has an activating or exciting effect which in mild doses may increase efficiency and in large doses reduce efficiency. Furthermore punishment, like reward, is informative as well as motivational, aiding the differentiation of a wrong response from a right one. Hence anyone who uses punishment to control behavior has several interacting principles to consider, and the outcome is hard to predict.

We noted at the end of Chapter 3 that a person observes best what he is set to observe, but that he observes a little in the margin of attention also. Exactly the same principle applies to learning. One learns most what he is set for, but he also learns a little incidentally. Walking to the drugstore, for instance, our friend Stone not only learns where to turn left and right to reach his goal; he also learns something of the situation along his route. He locates buildings and trees out of the corner of his eye, hears the characteristic sounds of the neighborhood, and smells that unique drugstore blend of disinfectants and toilet water. Some time later, when Stone needs flyspray, he may recall that he once saw some at the drugstore. *Incidental learning*, as it is called, is not an efficient way to learn, but we do acquire a little in this casual way. If the set were 100 percent focused, we would learn nothing except what we are trying to learn.

One experiment with college students furnishes some figures that show how large the effect of the set can be.²³ A group of students was asked to read a paragraph and learn as many ideas from it as they could. (Whatever the ulterior motivation may have been, the set was established by the instructions.) They remembered 51 ideas on the average. Another group was set to do something a little different: simply to read the paragraph. When they were unexpectedly tested to see how many ideas they had learned, their average was 38. Another group was given a more dissimilar set; they were instructed to count the words. When they were tested for the number of ideas they had learned with this set, their average was only 7.

Knowledge of Results and Correction. In simple learning situations the act to be learned is followed immediately by reinforcement of some sort. In complicated learning situations the consequences of an act may be delayed or abstract, and if one cannot integrate the act and its consequences, improvement is slow. When a person is practicing a complex skill, like playing the piano, he may know in a general way that he is doing well or not very well without knowing which parts of his performance are good and bad. Under such conditions any improvement in identification of successes and errors improves learning. A simple announcement of right or wrong at the proper time is often helpful, and this is one of the advantages of having a good

coach or teacher. In training animals mild punishment is often used, not so much for negative reinforcement as for information. In fact learning experiments have been arranged with high school and college students in which a disagreeable stimulus like an electric shock follows either the wrong response or the right response, and it makes no difference in rate of acquisition as long as the subjects know what the shock means.

Many psychological experiments on target practice of various kinds have demonstrated that practice with knowledge of results is superior to practice without such knowledge. You estimate the amount and direction of the error and make the necessary corrections on the next trial. You may receive useful feedback even while the activity is under way, as when aiming a garden hose. If you reach for a pencil and your aim is wrong, you see your error and correct your movement while it is in progress. This immediate perceptual feedback is very helpful and probably accounts for the fact that one learns to grasp things and to walk toward things early in life with relatively little difficulty. When a child is learning to move around in this world, perceptual errors are corrected as he moves. Since there are many cues for distance, there are many possibilities for information about errors and for correction of these.

Meaning. Which list would be easier to memorize?

KPJ MEQ VUZ GEX BUQ FUY PEH LEJ
PEONY RIDICULE TRANSITION BADGER DREAM HINGE
METAPHOR VICTORY

If someone is asked to learn the series 35842679, it takes a little practice. But if the task is to learn 14921776, it is very easy because dates have more meaning than unrelated numbers. Their meaning was acquired of course by previous learning, usually by cognitive organization. The events of history and the facts of a science are easier to learn after the textbook or the teacher has tied them together in a meaningful pattern. The general principle states that material which is meaningfully organized is easier to acquire than the same amount of unrelated material.

Even when the material to be acquired is meaningless nonsense, like telephone numbers, the names of the months, the bones of the body, and the words of some songs, people often put meaning into them somehow, and this is a good practice when you have to memorize meaningless things. One person, for example, diagramed 35842679 thus:



If one knows that there are two kinds of vision, color vision and twilight vision, and two kinds of receptor cells, rods and cones, but cannot remember which goes with which, a scheme like

cones
color

 may clear up the confusion. The most helpful *mnemonics*, as these tricks are called, are the ones you

invent yourself for organizing unrelated facts. Meanings of words will come in for more serious discussion in the next chapter.

Social Interaction. Learning is an individual affair, to be sure, but so much learning is dependent on the actions of other people that this social interaction can become a critical condition for learning. Frequently social interaction supplies the response which is practiced and the motivation for practicing it as well as the rewards and punishments for the results. At first the baby responds to a person as to any other thing, but he soon learns that these particular things apply rewards and punishments for his responses and that he can influence their activities by such instrumental acts as smiling and crying. Thus he becomes sensitive to other people and to the social reinforcements that people administer. Chapter 3 called this mechanism for controlling behavior a social motive.

Under the heading of operant conditioning we noted how the spontaneous activity of one person in a two-person situation can be shaped by social reinforcement administered by the other person. This is probably typical of many learning situations in the life of the young child. Thus communication and other social skills are acquired in social interaction and affected by social variables. Then after the child has learned to communicate, a parent or teacher can tell him directly what responses to practice. This kind of social interaction is called *instruction*, or guidance, or teaching, and it has the advantage of eliminating much unnecessary trial and error. But since active practice is better than passive practice, the best contribution of the parent, teacher, or coach is to show the learner what to do but not to do it for him. The child who makes his own mistakes and corrects them learns more than the child who is protected from mistakes. But expert guidance is particularly useful in complex situations, helping the learner to select which activities and which cognitive organizations to practice and which to avoid. As a rule positive recommendations for practice are more effective than negative recommendations.

To understand learning in social situations we must look at it from the learner's point of view. Parents and teachers are often trying to manipulate children by administration of rewards and punishments while the children are trying to manipulate the adults. The parent is reinforcing a desired habit while the child is learning how to get rewards out of the parent. For example, a child rewarded for eating his spinach may or may not learn to like spinach, but he will learn the spinach-eating trick for making the parent produce dessert. And social skills of this kind are more important in the development of the child than eating spinach.

Another kind of social interaction, important for learning, is *imitation*, which means that one person practices the activities he observes in another person. Much of a child's development after age three can be traced to imita-

tion of the activities of a parent or other adult or older brother or sister. Unlike instruction, imitation does not require the cooperation of the model.

Another kind of social learning is learning about oneself, and this is commonly learned through *identification* with someone else. A boy who has an emotional identification with his father not only practices the speech and the walk he observes in his father but adopts his father's likes and dislikes and his attitudes and values as far as he understands them. Within the limits of his ability he *is* his hero. The boy's concept of himself is acquired largely while he practices being the kind of person he thinks his father is, so we will find the principle of identification helpful in the discussion of the self in the next chapter.

It is a general rule that children, and adults as well, are most likely to imitate or identify with those people whom they respect, usually with those who occupy a prestige position because of real or apparent achievement in athletics, business, warfare, or beauty contests. Children and adolescents often shop around selectively among the people they know and the heroic models offered by movies, television, and books, adopting and practicing only the activities that fit in with their own pattern of motives.

Transfer of Training. Almost all learning is influenced, for better or worse, by previous learning. After age 10 a person has learned so much that when he undertakes to learn something else he seldom starts from zero. When Mr. Stone first sat behind the wheel of his new car, for example, some of the effects of his experience behind the wheel of his old car transferred to the new situation and he learned quite rapidly. In general, when learning or training in one situation has an effect on learning in another situation, either speeding it up or slowing it down, we call the effect *transfer of training* or a transfer effect.

Everyone expects some transfer effects to occur. The important questions are how much and why. Since transfer of training involves two tasks and two times, the design of a transfer experiment must be scrutinized carefully. We might test a group of 10 people on one task, memorizing dates, then have them practice on another task, memorizing poetry, then test them on memorizing dates again. The improvement on memorizing dates from the first test to the second could be taken as due to practice on memorizing poetry. The difficulty with this design is that there would be some unknown amount of improvement due to memorizing dates on two occasions which would be mixed up with the improvement due to transfer from memorizing poetry. As in many other psychological experiments we need a control group of 10 people to memorize dates twice with no intervening practice in memorizing poetry. The design of the experiment looks like this:

Practice group:	Memorize dates	Memorize poetry	Memorize dates
Control group:	Memorize dates		Memorize dates

If the practice group improves more than the control group, the difference must be due to transfer from the practice in memorizing poetry. In this particular example the amount of transfer would be quite small, but if the tasks are similar, as when one practices on 18th-century poetry and then 19th-century poetry, considerable transfer in memorizing skill will be noticed.

The rule is that transfer takes place when the two tasks to be learned have something in common, so the important question becomes: What can two tasks have in common? Both may be called by the same name, e.g., memorizing, but this is not enough. First, the two tasks may have certain specific components in common. Practice on tennis makes it easier to learn table tennis because the two games have certain perceptual skills and certain moves in common. Teachers and coaches facilitate transfer by pointing out such similarities. Second, the two may use similar principles or methods. Knowledge of the strategy of lawn tennis facilitates learning the strategy of table tennis. It is possible that a student may learn an efficient method of study, or a way of budgeting his time, or a trick for combating distractions while studying one course that helps him study other courses. One psychologist taught principles of memorizing to college students and found that they helped considerably in memorizing dates and facts, far more than practice in memorizing poetry did.²⁴ Likewise in associating letters and numbers a set to look for principles of association facilitates finding such principles and transferring them to another task.²⁵ The third type of common component is a general adjustment to the learning situation. Children who have had practice in handling tools have acquired confidence that helps them when they pick up new tools and try to use them. A person who talks or does anything in front of a group may acquire emotional control that makes it easier for him to learn other social skills in a group situation. Sometimes the transfer effect is negative, practice on one task interfering with the acquisition of another, and we shall have to consider this unfortunate phenomenon in the next section.

These principles of transfer of training have more than theoretical importance; they have practical importance in the design of programs of education and training. Psychologists working on training problems in military and industrial situations have found that, before starting men on expensive and dangerous machines, it is often possible to arrange blackboard practice or paper-and-pencil practice that will simulate and perhaps transfer to the real thing (see Fig. 6.13). In high school and college programs and prerequisites are often planned with the assumption that what is learned in one course aids learning in another course. This assumption may be true because of the common components noted above, but one can never be sure of the transfer until actual measurements are made with experimental and control groups.

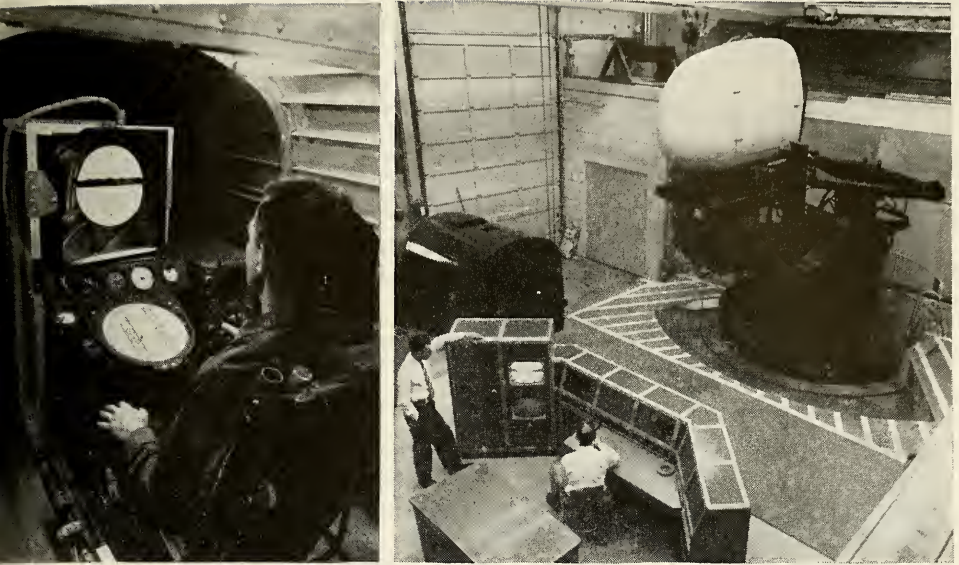


Fig. 6.13. Dynamic Flight Simulator. Flight problems on tape are presented to the pilot in a simulated helicopter cabin by closed-loop TV, dials, and displays, as seen at the left. While the pilot is attempting to respond to this information, the cabin is tilted, revolved, and accelerated by the apparatus shown at the right. Simulators are used for practice in a variety of flight conditions and for research on the transfer of such practice to actual flying. (Courtesy W. G. Matheny, Bell Helicopter Corp.)

PRACTICE PROBLEMS

23. In a famous experiment on learning, students were asked to study a list of nonsense syllables for nine minutes. One group spent all the time reading and, when tested, got 35 percent of them right. Another group spent 80 percent of the time reading and 20 percent reciting, and so on, as in the table at the right.²⁶ Which principle of acquisition is illustrated by the results?
- | | % learned |
|--------------|-----------|
| 100% reading | 35 |
| 20% reciting | 50 |
| 40% reciting | 54 |
| 60% reciting | 57 |
| 80% reciting | 74 |
- a. Active learning is better than passive learning.
 b. The best learning is motivated learning.
 c. Practice makes perfect.
 d. Meaningful material is easier to learn than artificial material.
 e. Spaced practice is better than massed practice.
24. In another part of the experiment just described, some students learned short biographies and were tested on what they had learned. From what you have read in this chapter what results would you expect?
- a. All reading and reciting schedules were equally good.
 b. Recitation was not necessary for this kind of material.
 c. The 80% recitation schedule was slightly better than the 20%.
 d. The 20% recitation schedule was slightly better than the 80%.
 e. Recitation was more necessary for this kind of material than for nonsense syllables.

25. Two psychology classes studied two different 10-item lists of words for one minute each. The lists and the average number of words recalled were as follows:

10 o'clock class	WINDOW CHAIR TABLE DOOR CEILING DESK WALL LIGHT FLOOR RADIATOR	6.7
11 o'clock class	REORGANIZATION AND ORGANIZATION OF MATTER A MOSTLY IS PSYCHOLOGY LEARNING	9.5

What accounts for the difference in amount learned?

26. Which term does not belong with the others: reinforcement, knowledge of results, feedback, reward, identification?
27. Which of the curves in Fig. 6.14 best graphs the relation between efficiency of learning and activity level?

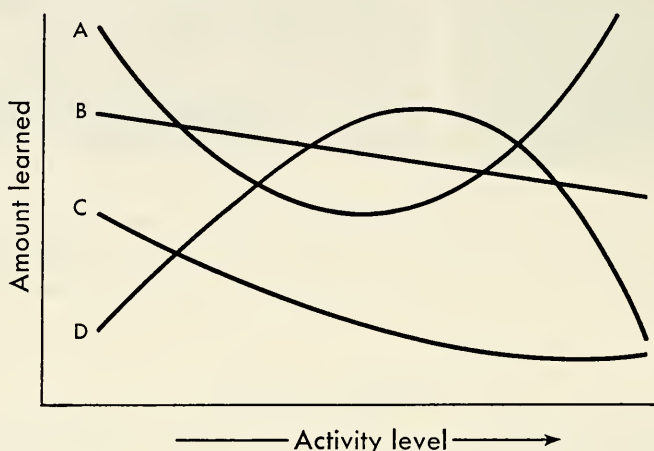


Fig. 6.14. Identification of curves.

28. Looking at the graphs in this book, do you see the dependent variable graphed more often on the vertical ordinate or on the baseline?
29. Mr. Stone's progress in typing is followed for a week, several measures being recorded and graphed. If all dependent variables are graphed on the same baseline, which pair of graphs will look most similar? (a) Successes and time; (b) errors and speed; (c) time and percent right; (d) errors and time.
30. Teachers often try to improve learning by manipulating motives and incentives. Which illustrates manipulation of an incentive?
- Opening a window when the classroom is warm.
 - Changing a 1 o'clock class to 11 o'clock.
 - Announcing that the next quiz will constitute half the grade.
 - Stressing the intrinsic importance of the subject.
31. Which list of nonsense syllables will be easier to learn and why?

List A: CEN DUC JEL LIF TER WAT LIQ MOD REG SUB

List B: FEH JID QOC TOV WUB XAD DAX LAJ MEQ YIM

32. Which of the curves of Fig. 6.15 begins after some transfer from previous learning has occurred?

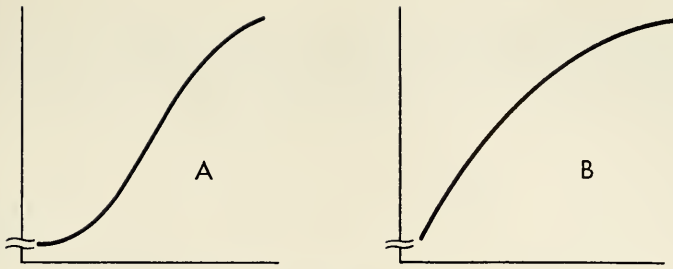


Fig. 6.15. Identification of curves.

RETENTION AND FORGETTING

The acquisition of new response patterns is not all of learning. As time passes, if the learner does not practice, some of the recently acquired material may be forgotten. Holding on to what was acquired is called *retention*; forgetting is the opposite. Or, in other words, acquisition refers to changes in performance during practice, while retention refers to changes after practice has ceased.

A practice experiment has to be carefully designed in order to analyze the conditions that influence acquisition; for the same reason, a retention experiment has to be carefully designed in order to analyze the conditions that favor retention of what has been acquired. We have someone practice, e.g., memorize a list of words, then we give him a test and get a score representing his performance on that task. Let us say he gets 16 words right. Then we have an interval of no practice, perhaps an hour, a day, or a month, and we test him again. If he gets 12 words right on the second test, he has forgotten 4, or 25 percent, and retained 75 percent. In general, we take the score just after practice as a reference level and transform the score on the second test some time later into a percentage of the first score. The sequence of events in an investigation of retention looks like this:

Practice	Test 1	Retention interval	Test 2
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Since 1885 when Hermann Ebbinghaus, the great German psychologist, performed the first experiments on memory, psychologists have carried out many such experiments and have shown that the fraction retained depends on such conditions as overlearning, interference, organization, and trauma.

Overlearning

Learning projects of long duration, like learning to type and learning a foreign language, include periods of practice and periods of no practice. Such a project may be pictured as a race between acquisition and forgetting, as in

Fig. 6.16. If one learns to do something once or twice and then stops practicing, forgetting begins immediately. But if practice continues, even though no improvement is noticed, such *overlearning* slows the forgetting (see Fig.

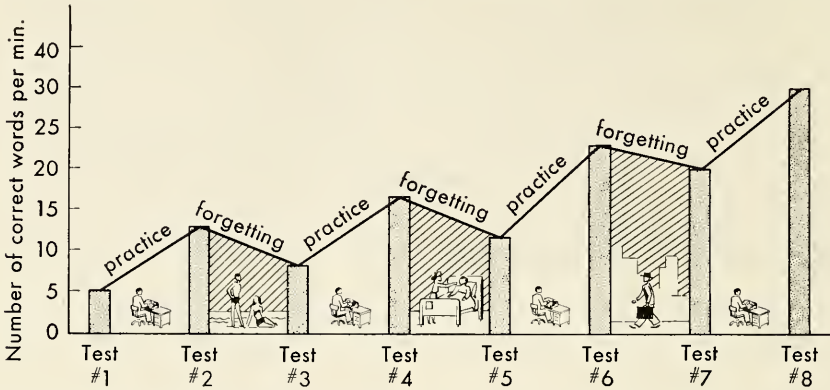


Fig. 6.16. Learning to type: a race between practice and forgetting. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

6.17). Things that we use often, like simple arithmetic, the native language, eating habits, social customs, and ways of getting dressed, are seldom forgotten because they are practiced beyond the level necessary for correct performance, and this *overlearning* is one of the best ways to combat forgetting.

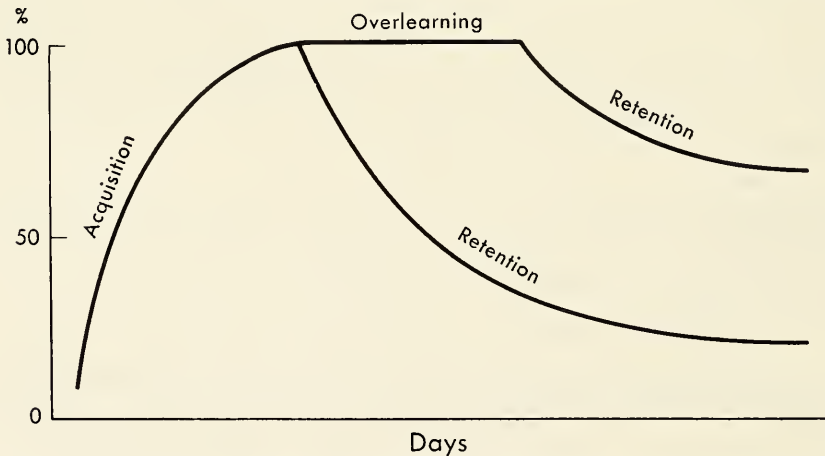


Fig. 6.17. Effect of overlearning on forgetting. If practice ceases as soon as the material has been acquired, forgetting begins at once and the retention curve drops rapidly. If practice continues past the point of correct performance, then, after practice ceases, the retention curve holds up better.

Interference

Most forgetting is due to learning something else. If someone learns a list of 12 unrelated words today and is tested tomorrow, he will probably recall

about 75 percent of the words. If he memorizes eight such lists today, will his ability to recall improve? On the contrary, memory of the eighth list will be confused with the previous seven lists so that he will retain only about 25 percent.²⁷ And, in the other direction, memory of the first list will be confused with the seven lists that are learned later. Interference that seems to work forward, inhibiting retention of what is to be learned in the future, is called *proactive interference*. Interference that acts backward, inhibiting memory of what has been learned in the past, is called *retroactive interference*. Not only does the interference reduce the number of words recalled, but those words that are recalled are often errors, intrusions from other lists learned earlier or later.

As an illustration of retroactive interference let us suppose that Sam Thomas (Fig. 6.18) comes into David Stone's jewelry store one fine December day during the Christmas rush and introduces himself. Then,

about the middle of February, Thomas stops in again. Will our hero remember his name? Probably not, because the memory for this name and face has been crowded out by the memory of other names and faces. Perhaps Thomas made an impression on Stone and the latter tried to associate the name with the face, but between December and February Stone met Lou Stiven, Tom Samuelson, Sam Kurtz, Sam Berg, Al Drabek, and Tom Swanson. And, unfortunately, the association between the name and face of Sam Thomas is overlapped and confused by the effects of other names and faces. If Stone does call the man by name, he may call him

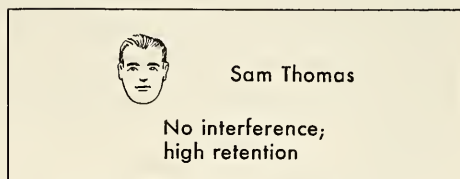


Fig. 6.18. Interference and retention. (Figs. 6.18, 6.19 and 6.23 from Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

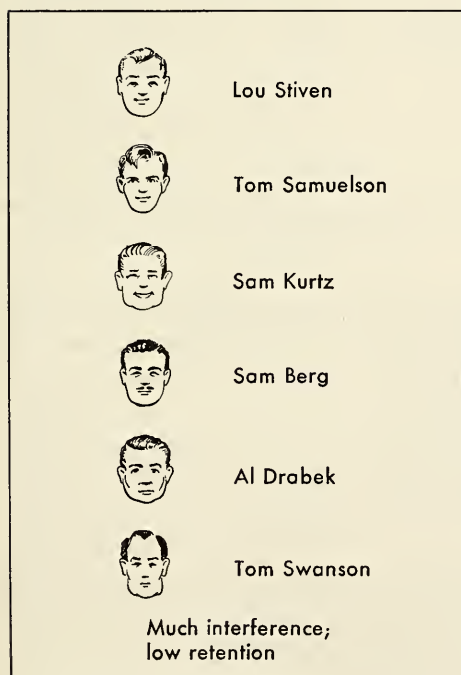


Fig. 6.19. Interference and retention.

Sam Thompson or Tom Sampson. Retroactive interference is a kind of transfer effect but the effect is negative rather than positive (see Fig. 6.19).

In the ordinary situations of daily life we know that interference occurs and indeed, when we try to recall a name or a fact or a number, we often recall an intrusion from the interfering activity, but we do not usually know just what the interfering activity was nor when it occurred. In the laboratory it is possible to arrange various kinds of activities during the retention period and measure the amount of interference. An experiment investigating the retroactive interference of learning B on retention of A might be planned like this:

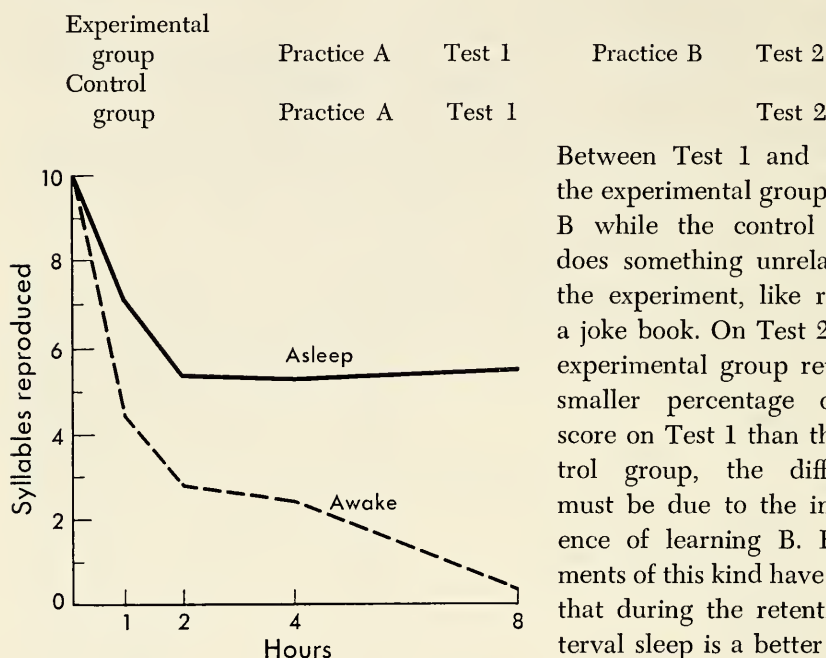


Fig. 6.20. Activity and retention. The subject learned lists of 10 nonsense syllables, then was tested on these one, two, four, and eight hours later. The upper curve shows good retention at night when the intervals between tests were spent asleep in a laboratory bed, and the lower curve shows poor retention during the daytime when the intervals between tests were spent in routine activities. Each point is the average of 8 tests on one subject, and the results for another subject were quite similar. (From Jenkins and Dallenbach²⁸)

Between Test 1 and Test 2 the experimental group learns B while the control group does something unrelated to the experiment, like reading a joke book. On Test 2 if the experimental group retains a smaller percentage of the score on Test 1 than the control group, the difference must be due to the interference of learning B. Experiments of this kind have shown that during the retention interval sleep is a better condition for retention than activity²⁸ (see Fig. 6.20). But it is more than a matter of amount of activity; the kind of activity is very important, and the general rule is that the most interference comes from activity similar to the activity to

be remembered. Studying German immediately after studying Spanish would be bad for the retention of the Spanish—and probably for the German also. Practicing tap dancing after studying Spanish would do little harm.

Organization

Another condition influencing interference and thus forgetting is the organization of the material. When many unrelated items are memorized, like

numbers, nonsense syllables, and names, anything can interfere with anything else learned earlier or later, and the interference is maximal. The simplest organization is a kind of figure-ground organization, attained by putting a number in a list of words or printing one word in a different color from the others. When this is done, the isolated or emphasized item is remembered especially well. If a speaker emphasizes one particular fact by a gesture or by raising his voice or by stating that it is important, that fact will be isolated and less subject to interference by other facts. But the most stable and useful kind of organization is the meaningful or cognitive organization discussed earlier in this chapter. If a person gets the gist of a story when he hears it, he remembers this even though retroactive interference crowds out many of the details. Fig. 6.21 attempts to summarize several experiments that have

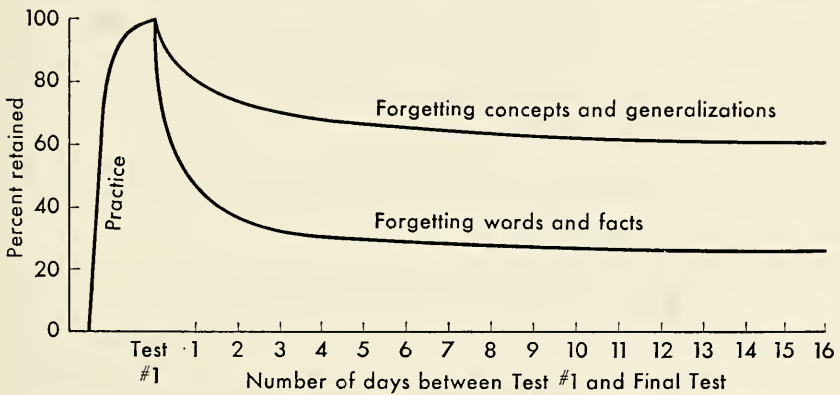


Fig. 6.21. Retention curves for organized and unorganized material. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)

compared the retention of unrelated words and facts with the retention of concepts, generalizations, and other meaningfully organized material.

Amnesia

Amnesia is a medical term for loss of memory. The nerve cells that retain the effects of practice are living tissue and hence are susceptible to several kinds of damage. In elderly people hardening of the arteries of the brain impedes circulation and often produces a spotty kind of memory loss, particularly for recent events. Accidents serious enough to cause unconsciousness may also produce loss of memory. If a person receives a serious blow on the head at 11:30, he may, when he recovers, have no memory for the events between 11:15 and 11:30. This is forgetting of a sort, probably caused by disturbance of the neural memory traces before they have become thoroughly consolidated. Similar effects can be experimentally produced in animals by electric shock immediately after acquisition of a new response pattern. In many

cases, but not all, the lost memories gradually come back. There is no doubt that direct electrical, chemical, and mechanical disturbance of the brain tissue can produce more or less memory loss, but fortunately the brain is so well protected in its bony cranium that such disturbances are rare. Most cases of amnesia have another origin, as we shall see in the section on remembering.

Memory Training

On the basis of these principles a few practical suggestions can be made.

Learn as much as possible before you start to forget. If you have learned enough, you can forget 40 percent and still retain a lot.

Overlearn. Beware of that illusory feeling of familiarity that comes when you can do something correctly once. Use what you have learned in several different situations. To remember a person's name, for example, use it several times soon after you are introduced, and call him by name when you say good-by.

Review frequently. Four half-hour reviews are better than one two-hour review. If you study French in college, read a few pages of French every month after you leave college.

From the principle of retroactive inhibition it follows that the best way to remember something would be to learn nothing else, that is, to lapse into a state of suspended animation. For those who are unwilling to go all the way, the next best condition is sleep. But if one must be active and learning things, one can at least schedule learning so that similar activities are not too close together. And this is one principle that can be reversed. If you have a phrase or a singing commercial running through your head and cannot get rid of it, practice a second tune to interfere with the first one. Getting rid of the second will then be easier.

Organize what you learn in a meaningful way. This is the best way to make your knowledge resistant to interference.

Note material subject to interference and isolate it. For example, if a term is used in different ways in different courses, identify such terms and take time to clear up the confusion.

PRACTICE PROBLEMS

33. What was the independent variable of the experiment graphed in Fig. 6.20?
34. Can we infer from this graph that the testing schedule was the same under sleep conditions as under awake conditions?
35. Can we infer from this graph that sleep is a condition something like amnesia?
36. Extinction of a conditioned response can be considered a simple kind of retroactive interference if we assume that (a) in most situations conditioning is a special kind of negative transfer effect; (b) when the S_c is not reinforced, the

animal learns a response that inhibits the conditioned response; (c) when the animal perceives the S_{ii} , he must be observing other stimuli simultaneously; (d) conditioned responses are made in anticipation of more than one kind of reinforcement.

37. When a list of words is memorized and records are kept for each word, it always turns out that the first and last of the list are learned before the middle portion.²⁹ See Fig. 6.22 for typical results. Which would be the most plausible

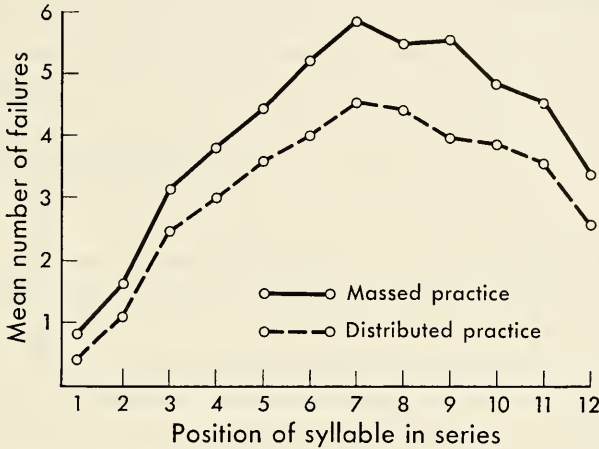


Fig. 6.22. Serial position curves obtained under conditions of massed and distributed practice. (From Hovland²⁹)

explanation?

- The most meaningful words are learned first.
 - Positive and negative acceleration.
 - Overlearning of some words.
 - Proactive and retroactive interference.
38. Look back a few pages to the plan of an experiment for investigating the retroactive interference of learning B on retention of A. Plan a similar experiment to investigate the proactive interference of learning B on retention of A.
39. Miss A and Miss B memorized a list of 20 words. Miss A worked five minutes and had 14 of them right when she quit. Miss B worked seven minutes and had 18 right when she quit. The next day Miss A was able to recall 8 and Miss B 9. Who retained more of what she learned?

REMEMBERING

The complete account of learning includes the acquisition of new material, the retention of some or all of this over an interval without practice, and a final performance or test. One who has memorized a poem likes to see how well he can repeat it, and teachers, coaches, and animal trainers like to see if their pupils do what they have been taught. But performance on a test, or on any other occasion, is seldom an exact repetition of performance at any

previous time. The performance depends on previous acquisition and retention but also on the present situation and present motivation. To analyze how and to what extent performance depends on previous learning we need good tests of remembering and we need to give them under various conditions and find out how these conditions influence what is remembered.

Tests of Remembering

A basic question is the question of how many things one can remember immediately after hearing them. The experimenter reads four digits, such as 2964, and asks the subject to repeat them. If he gets them all right, he can try five digits, 58137, then six, and so on. He has to remember them only long enough to repeat them, so this task is called immediate memory, and the largest number of digits recalled correctly is called the *span of immediate memory*. Immediate memory for consonants, such as k m w t, and v l f t c, is tested in the same way, and in both cases the span for the average adult is around six or seven. This seems to be a kind of upper limit

of the individual's ability to grasp or attend to things momentarily and thus is reduced by anything that reduces intellectual efficiency in general, such as alcohol, extreme fatigue, and distractions. If the subject is asked to repeat the digits backward, he has a little more work to do and the span is a little smaller.

Retention of a skill, like typing, can be tested by giving the subject a standard task, e.g., a letter of standard difficulty, and scoring his performance in terms of amount done, errors, or time. If the material learned is poetry, information, and the like, reproduction of what has been learned goes by the name of *recall*. "When was the Battle of the Bulge?" "What are the distinguishing characteristics of lepidoptera?" An easier test is *recognition*. Which of the faces in Fig. 6.23 appeared in an earlier figure? Many of the tests used to measure achievement in college ask for recall or recognition and, in addition, for reorganization of the remembered material or for use of this material in solving problems. Another method for testing the

effects of learning, a delicate method that uncovers slight traces too weak for recall, is *relearning*. Let us say that a student in English 14A memorized a certain poem in 40 minutes and repeated it correctly in class. One year

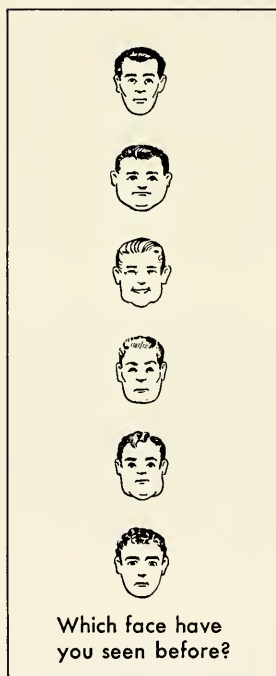


Fig. 6.23. Retention of faces.

later he is asked to reproduce the poem, but he cannot recall a word of it. Forgetting appears to be complete; retention is zero. But let us ask this student to memorize the poem again, to relearn it. He will probably not need 40 minutes but definitely less. If he needs only 30 minutes to do what he previously did in 40 minutes, other conditions being equal, he must have remembered enough to save 10 minutes, or 25 percent. The evidence on acquisition and retention presented in this chapter has come from experiments using these methods of testing. When the working conditions are good and the motivation to remember is adequate, these tests tell us how much has been learned.

Conditions of Remembering

The effort to remember is influenced, as other intellectual activities are, by anything that influences general efficiency: room temperature, alertness, distraction, boredom, emotional excitement, alcohol, and other drugs. The influence of emotion on recall may be serious during examinations in school and on the witness stand, especially under the stress of cross-examination. Likewise, in the excitement of military combat, competitive athletics, automobile accidents, and other emergencies one may forget skills that he had mastered quite well under calm conditions. The remedy of course is to practice under exciting conditions. Emotional conditions, by their very nature, are difficult to arrange, but fire drills that seem to be genuine are better training than obvious fakes, and some students claim that it is helpful to simulate stressful examination conditions while preparing for an examination.

The situation in which the remembering is done may have a more specific influence because, as a rule, remembering is best in situations that are similar to the situation in which the learning was done. You may be able to remember someone's name in the room where you usually see him but not when you happen to meet him in different surroundings. Likewise, recall of facts, names, and dates is often improved if preceded by a review of the context in which these items usually appear. If you cannot immediately recall a specific historical fact—say, the name of the vice-president during Hoover's administration—you may be able to recall interesting controversies and other facts of that period, and events that preceded and followed it, and the vice-president's role in these, and thus arrive indirectly at his name. This possibility demonstrates again the advantage of learning a cognitive organization of the facts.

The *set to remember* is perhaps the most important factor in remembering. When someone attempts to recall a telephone number, or a limerick, or the face of his fifth-grade teacher, he is set to reproduce the previously

learned material completely and accurately. This is a rather artificial undertaking, oriented toward the past. More often he is oriented toward some task in the present and makes use of previously learned material when, as, and if it suits his purpose. If he is working a calculus problem, he may try to recall some algebra, but not all the algebra he has learned, and not in the form in which he learned it. When our friend David Stone gets into a political argument and recalls some facts from the Hoover administration, he does this selectively, recalling what he needs to prove his point. In general the set determines how one selects the material from his storehouse of memory, and that is why psychologists say that remembering is constructive as well as reproductive.

Telling stories is an activity that is oriented partly toward the past, when the story was acquired, and partly toward the present situation. Any good storyteller adapts his story to his audience, observes smiles, scowls, restless movements, and other feedback, and edits his recital accordingly. One high school girl of 14 heard the following story and was later asked to repeat it as accurately as possible.

There is a new boy in algebra class who is very good at working problems. He is an Indian and used to live on a reservation in Minnesota where he went to school by canoe. He is going to wear Indian costume and do a tribal dance at the next assembly. When the teacher called on him to go to the board and find the area of a parallelogram, he did it in his head while walking up to the board. Somebody said his father is related to the chief of his tribe.

Her immediate reproduction of this story was as follows.

There is a new boy in our algebra class who is very smart. He is an Indian and is going to do a tribal dance in the next assembly. When the teacher called on him to come up to the board and find the area of a parallelogram, he did it while walking up. Somebody says his father is relative to the chief of the tribe.

A little later, she told the story to another girl, a good friend, as follows.

Jeepers! You know what, there's a new guy in algebra. What a doll. And what a brain. Battleaxe calls on him to find the area of something or other, and he's done before Old Battleaxe can even figure it out. It must be nice. His father's chief of a tribe and they're gonna do a tribal dance. He's an Indian.

Still later she told the story to her mother as follows.

Guess what! There's a new guy in our algebra class who is really a brain. The teacher called on him to find the area of a parallelogram and he did it in his head before he got to the board. In our next assembly he's going to do some of the tribal dances the chief taught him.

In general, experiments of this kind have disclosed additions to embellish the story and entertain, omissions of the less exciting and the obscure parts, and modifications to fit the purpose of the narrator and his audience. Some

of these alterations are errors of recall, but others can be called errors only if we assume that the narrator was set to reproduce the story verbatim. We might call these motivated changes rather than errors. The set, as noted in Chapter 3, depends on the motivation for telling the story, plus the atmosphere of the social situation in which it is told. And the set may change. If the storyteller sees reinforcing smiles, he may try to remember more of the colorful details that evoked the social reinforcement.

In a court of law or before a congressional investigating committee a witness may be set to tell the truth, the whole truth, and nothing but the truth, or he may try to remember selectively to aid or embarrass the accused. Even this set may change, for under aggressive cross-examination a witness may become defensive and remember only what agrees with his previous testimony.

Sometimes the motivation at the time of recall inhibits recall more or less completely. When young David Stone asks his father how he got along in school when he was a boy, will Mr. Stone try to remember everything? He will probably screen his memories and recall only those that he believes his son should hear. Memory of particularly nasty events arouses so much anxiety that he hesitates to recall them even to himself. This inhibition of recall because of the anxiety which the recall arouses is called *repression*. Proof that failure to recall is due to the conditions of recall rather than to failure of retention comes from changing the conditions of recall. Repressed material may be recalled under the influence of certain drugs, under hypnosis, by free association, or when the subject acquires more confidence in the listener's discretion. Most amnesias, such as a loss of memory for one's own name and identity, are due to repression, and the memory usually returns when conditions are changed.

INDIVIDUAL DIFFERENCES

As a general statement we can say that ability to learn rises in the first two or three decades of life, then slowly declines. But the details are more interesting than the general trend. The typical adult does not learn by the same methods or with the same enthusiasm as the typical child. He approaches a novel task with circumspection, conscious of his dignity and his prior commitments, depending less on random activity and more on organization. Since adults' interests are more specialized than children's, they cannot be motivated so easily. Since they have had more experience, they are more susceptible to transfer of training, both positive transfer and negative transfer or interference. Hence a man of 50 can learn new aspects or extensions of his lifetime occupation quite readily but has more difficulty than a younger man if he has to change occupations.

The test of immediate memory span is commonly used to compare individuals because the scores are related to success on many tasks. In fact this test is part of several standard tests of general intelligence that we shall come across in Chapter 11. Since the memory span rises regularly with age, young children are tried out on three digits while adults are started on five or six. The average adult can get six or seven correct; the average college student gets about eight.

At any age, if a number of people are tested by any of the learning tests described in this chapter, some will get higher scores than others, and these differences in amount remembered now must be due to differences in amount learned in the past. Usually we cannot check on their past learning, but we know from the principles of this chapter that differences in motivation, opportunity for practice or study, methods of learning, and abilities are important. We can test individual differences in ability to learn somewhat more precisely by having all individuals learn a standard assignment in a standard situation. Under such controlled conditions learning scores depend chiefly on transfer from previous learning and on learning abilities. We cannot, unless we begin with newborn babies, test learning abilities free from the possibility of transfer.

When tests that require learning various kinds of material are given under controlled laboratory conditions, no clear-cut evidence is found for a general learning ability that aids the acquisition of all kinds of material.³⁰ If we wish to predict how much one will learn when given the opportunity, as when we select applicants for a special training program, we need to know his interests and his special abilities, such as artistic talents, facility with words, facility with numbers, comprehension of spatial relations, and dexterity with the hands. General intelligence comes into its own as a predictor of learning when the material consists of concepts and generalizations, the stuff that schoolbooks are made of. People with high scores on intelligence tests do not learn simple things, like conditioned responses and telephone numbers, faster than people with low scores. Their superiority lies in being able to understand difficult material and to comprehend the relationships that facilitate transfer of training. When white rats and college sophomores are run in mazes of the same pattern, the rats learn slightly faster—but they cannot learn abstract principles of learning.

SUMMARY

Learning is a persistent change in behavior resulting from practice. The changes are recorded in terms of an increase in speed and accuracy or a shift in type of activity. Learning can be divided, for scientific analysis, into acquisition, retention, and remembering.

A simple response can be acquired by conditioning, and such a conditioned response may be reinforced by S_n or extinguished by absence of reinforcement. Under some conditions the response will generalize to a different S_c . Similar effects occur in operant or instrumental conditioning, but the reinforcement is somewhat more complex. Intermittent reinforcement in particular produces a curious resistance to extinction. Selective learning occurs in more complex situations; the motivated learner makes various responses and certain of these, associated somehow with goal activities, are reinforced while others are extinguished. A more intellectual type of learning is cognitive organization; the learner acquires new knowledge of the situation so that he understands what he has to do in order to get what he wants. Whatever the motivation and whatever the type of original learning, if practice continues and all goes well, the separate acts are integrated in a smooth skilled performance.

In any case learning requires practice and, on most repetitive tasks, distributed practice is more efficient than massed practice. An alert condition is better for any kind of learning than a passive condition, and the best condition is a set focused specifically on the acts to be acquired. Some things are learned incidentally, when one is set for other things, but this is not an efficient way to learn. When the situation is complicated, knowledge of results and correction of errors improves progress, and so does any form of organization of the material to be learned. The learning of human beings, living in a social environment, is motivated and reinforced by others; indeed, they learn by instruction from others, they imitate the actions of others, and they may even acquire personal habits by identification with others whom they admire. Over and above all these principles is transfer of training, for most things one learns are like other things he has learned before and his previous acquisitions usually transfer to the present task—for better or worse.

Once new material has been acquired, the next question is whether it will be retained or forgotten. Retention is increased by overlearning and organization of the material and decreased by interference, either proactive interference or retroactive interference, and occasionally by neurological disturbances. These principles lead to some practical suggestions for study.

The final question is how much of what has been acquired and retained will be remembered on a later occasion. Remembering, as tested by reproduction, recall, recognition, or relearning, is reduced by any decrease in general efficiency, as by emotion, and by a distinct change of context or surroundings. But one does not always try to remember with complete accuracy. One may be set to entertain, to impress, or to oppose, and thus to make use of previously acquired material as it fits his present audience and his purposes. If the recall of a particular item would produce anxiety, he may

repress it, even, in severe cases, to the extent of repressing his own identity.

Some people remember more than others, of course, and these differences are due to differences in motivation to learn, in opportunities for practice, in methods used, and in abilities, especially in ability to transfer. There seems to be no general ability to learn all kinds of material; rather, there are different abilities responsible for the acquisition of different kinds of material, e.g., words and numbers. Those who get high scores on intelligence tests do not necessarily learn faster than others; their superiority rests in their ability to master difficult abstract material that others do not understand.

PRACTICE PROBLEMS

40. Compare the girl's story about the Indian as she told it to her friend with the original and guess which was the most prominent motive for telling it: (a) to inform; (b) to shock; (c) to demonstrate her maturity; (d) to entertain.
41. The relearning method of testing remembering has another name which refers to the computations that measure it. Which of these is the most likely synonym? (a) Reconstruction technique; (b) savings method; (c) transformation method; (d) relative extinction.
42. Chapter 2 described a physiological method for the investigation of selective remembering. What was it?
43. In Part I of an interesting experiment on learning, college students were asked to match each of 20 nonsense syllables, such as *sil* and *jax*, with a geometric design, such as a triangle and a wavy line, that seemed to fit it.³¹ Then, although they had not expected it, they were asked to recall as many of the syllables as they could. In Part II they were asked to memorize another list of 20 nonsense syllables, and they recalled 4.55 on the average for the first trial, 8.00 for the second trial, then 11.24, and 13.23. Learning in Part II shows (a) negative acceleration; (b) positive acceleration; (c) insight; (d) approach to a physiological limit.
44. The learning tested in Part I would be called (a) perceptual learning; (b) conceptual learning; (c) cognitive organization; (d) incidental learning.
45. From the above facts estimate the average number of syllables recalled in Part I: 0, 0.5, 2.7, 4.5, 14.1.
46. What was the purpose of the matching task of Part I?
47. An experiment by an Air Force psychologist had airmen practice moving a control stick or lever to an angle of exactly 33.57 degrees. Each airman had 20 seconds to try this, 5 seconds to rest, 20 seconds to try it again, and so on. Each subject in one group of 48 airmen was informed of his success or amount of error immediately. In another group of 48 the information about error came after the subject had made the next movement. Another group got the feedback after a delay of two trials, and another group after three trials³² (see Fig. 6.24). The principal independent variable under investigation was (a) amplitude of movement; (b) knowledge of results; (c) nature of the reward; (d) the set of the learner.
48. The dependent variable was (a) time of response; (b) number of successes; (c) direction of the error; (d) magnitude of the error.

49. We may infer that the motivation of the airmen was (a) unspecified social motivation; (b) unspecified biological motivation; (c) mild pain for inaccurate movement; (d) competition with potential enemy air force.

Referring to Fig. 6.24, mark each statement T if it is a valid inference from the graph. Mark it F if it contradicts the graph. Mark it N if the graph does not show whether it is T or F.

50. ____ All groups improved.
51. ____ The groups with no delay and with one-trial delay improved.
52. ____ Delay of knowledge of results is an important variable in this kind of learning.
53. ____ All groups show a constant rate of improvement.
54. ____ A short delay in knowledge of results is the optimum condition for learning.
55. ____ The airmen in the no-delay group were superior learners.
56. ____ The group with the three-trial delay showed the most improvement during the experiment.
57. ____ The reversal in positions of the two-trial and the three-trial groups is in accord with the general trend of the data.
58. ____ The irregularity in the practice curves is due to the usual experimenter's error in reading the instruments.
59. ____ The group with the two-trial delay was more highly motivated than the group with the three-trial delay.
60. ____ The three-trial-delay group retained the largest percentage of what they acquired.
61. Span of immediate memory is tested by (a) recall; (b) recognition; (c) relearning.

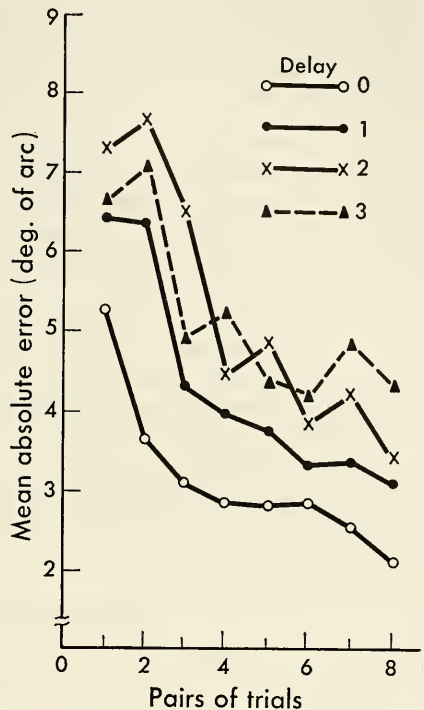


Fig. 6.24. Mean absolute error in lever placement for successive pairs of trials. (From Bilodeau³²)

The subjects of a learning experiment were asked to learn a series of 14 colored geometric forms, such as red triangle, gray moon, blue cross, presented at three-second intervals.³³ Group A was told they would be paid well for correct learning of the forms. Group B was told to learn the forms but not to try very hard. "Try to pay just enough attention to keep up with the task, as you would in listening to a lecture which does not interest you."

62. Which group got the best average score for learning the forms?
63. Which group got the best average score for learning the colors?
64. What principle was tested by this experiment?

Write down at your leisure some time 20 incidents of your life last year. Then classify each as P for pleasant, U for unpleasant, or N for neutral or indifferent. Similar investigations with different groups of people usually produce a large number of P memories, a smaller number of U memories, and an even smaller number of N memories. Read the following statements, which attempt to explain these facts, and from your knowledge of the principles of remembering, mark each T for true or F for false.

65. _____ U memories are repressed.
66. _____ N memories are repressed.
67. _____ N memories are lost by retroactive interference.
68. _____ P is larger than U because of repression.
69. _____ P is larger than N because people have more pleasant than neutral experiences.
70. _____ U is larger than N because people have more unpleasant than neutral experiences.
71. _____ P is larger than N because of selective learning.
72. In experiments on conditioning there are always some people who condition better than others. Would these be the ones who get high scores on a test of anxiety or low scores?³⁴
73. Is it true that fast learners make more mistakes than slow learners?
74. "Quick learners are quick forgetters." True or false?

Discussion Questions

- A. Considering the motivation of learning, how does punishment differ from reward?
- B. What does it mean to say that remembering is constructive as well as reproductive?
- C. What would your life be like if your memory were limited to 15 minutes?

Recommended Reading

- I. M. L. Hunter. *Memory: Facts and fallacies*. Penguin Books, 1959. A simple account in paperback form of memorizing, forgetting, recalling, repressing, and improving memory.
- J. E. Deese. *The Psychology of Learning*. (2nd ed.) McGraw-Hill, 1958. A standard textbook for college students, covering methods, results, and theories.
- G. Katona. *Organizing and memorizing*. Columbia Univer. Press, 1940. A report of experiments comparing learning by rote and learning by cognitive organization, showing the superior transfer value of the latter.
- E. R. Hilgard. *Theories of learning*. (2nd ed.) Appleton-Century-Crofts, 1956. A scholarly discussion and judicious evaluation of nine major approaches to learning.

Chapter 7. ACHIEVEMENTS OF LEARNING

Knowing the general principles of learning we need next to look more specifically at some of the achievements of learning and see what people acquire in their daily practice all along the journey from the cradle to the grave. This is the theme of much of modern psychology, to be sure, and in previous chapters we have examined the learning of emotions and motives as in later chapters we shall examine the learning of social habits and attitudes. In this chapter we group some important learned accomplishments, for convenience of study, into a few broad classes, roughly according to present trends of psychological research, and see how the principles of learning help us to understand the achievements of complex human beings in a complex physical and social environment.

PERCEPTION

A good share of what we learn is perceptual learning, learning the location and significance of things, acquiring perceptual habits and sets, and reorganizing what is perceived into new cognitive patterns that are more rewarding than the old. It is not the senses that are improved. Despite many attempts no one has proved that practice will correct nearsightedness or color blindness. But the organization of sensory information into meaningful patterns is slanted one way or another by practice in perceiving.

The world that continually stimulates the sense organs could be a booming buzzing confusion, but one thing that perception does for us is to analyze the confusion and identify those stimulus patterns that can be used as cues to action. One of the earliest cognitive organizations is the differentiation of interesting stimuli, those that act as positive or negative reinforcers, from the uninteresting background. Some of these identifications may come from conditioning because a visual stimulus, S_c , such as a hot

object, that is followed immediately by pain, S_u , becomes more noticeable and is perceptually differentiated from non-painful background stimuli. Selective learning comes into operation when the perceptual field can be organized into several patterns alternatively—that is, when an object looks different from different angles or when something is heard before it is seen. At dusk an object may be seen first as a bush, then as a man, then as a scarecrow. When one interpretation is finally accepted, the others are often called *illusions*. This kind of learning does not depend on external reward; stable cognition of the environment is reward enough.

Sign learning can be considered perceptual learning in many cases. If a stimulus, e.g., a black cloud, often precedes an event, e.g., rain, one sees the stimulus as having some of the character of the event that follows, and we say that the cloud “looks threatening.” After a few years of snow and cold, one who looks out the window and sees freshly fallen snow may say it “looks cold.” Later, when the edges of the snow have retreated and water shows here and there, he may say it “looks warmer.”

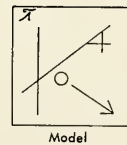
Another aspect of perceptual learning is the differentiation of perceptual qualities or dimensions. One perceives objects warmer than the body and colder than the body and gradually isolates temperature as a continuous dimension, different from other environmental qualities. In the same way, near objects are located by hand and far objects by vision, but one gradually combines the various kinds of information about distance and learns to perceive all objects on a scale of distance extending continuously in all directions.

Some perceptual learning depends on social interaction, for in many cases one does not know what to look for or listen to until a teacher or friend points it out. A large part of learning to cook is learning how the food looks, or smells, or feels at the best moment for removing it from the fire, and if one learns from an expert what to observe, the omelet may be worth the trouble. Reading words is a perceptual achievement that depends on social interaction and on long hard practice with much correction; as long as one reads successfully, the achievement is continually reinforced. But even in adult years, when words are exposed very briefly with split-second timing, those words that appear frequently in ordinary reading matter are perceived quicker than words that appear less frequently.¹

To follow the course of perceptual learning it may be sufficient to record errors in estimates of size or distance, or in recognition of objects, and note how these decrease with practice. If we wish to study how perceptual organization changes with practice, some kind of description or reproduction is necessary. We can ask someone to look for a moment at an unfamiliar design such as the model in Fig. 7.1, then to describe it or, better, to draw it. Repeating this practice until learning is complete yields a record, as in Fig.

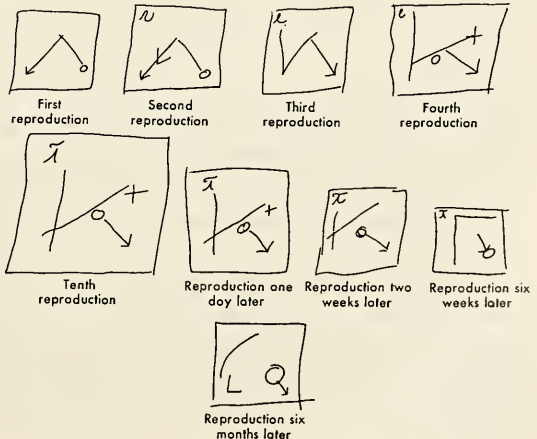
7.1, of progressive improvement. Retention is studied in the same way—by asking the subject to draw what he remembers at different intervals after his last view of the design, though one must note that each attempt at reproduction affords an opportunity for practice and that the reproductions include errors of drawing as well as errors of perception. Such reproduction records show that the general outline is mastered quickly and forgotten slowly. Details are usually learned with more difficulty, but an outstanding detail, like the *T* in the model, may be acquired quickly and retained well.

Perception of three-dimensional objects in space may improve rapidly because, unlike the experiment pictured in Fig. 7.1, the situation yields immediate knowledge of results and correction of errors. Someone entering a dark room and feeling for the light switch is rewarded immediately when he locates it. Someone who misperceives the height of a step stumbles immediately. The intricate neural connections in the retina and the visual areas of the brain make possible rapid feedback and correction of some visual errors. As one moves his head, perception of an object at one moment is quickly checked by perception from a different angle a moment later (see Figs. 5.11 and 5.12). If one extends his hand to grasp an object in view, the hand is in view and errors in reaching movements are quickly corrected. In the same way the three-dimensional significance of shadows on the unlighted side of a solid object is easily related to other information about the object. Not only are these achievements acquired easily; they are well retained because they are usually overlearned and because there is little opportunity for retroactive interference. Research by military psychologists



Model

Fig. 7.1. Perceptual learning and forgetting. The model was shown to the subject for 10 seconds, then she was asked to draw it. One day later she was given another 10-second look, and she drew the second reproduction. And so on, once a day. After 10 trials the design was reasonably well learned. To check on the course of forgetting, the subject was asked on the 11th day to draw the design from memory. Retention for one day was quite good, and even for two weeks. Later reproductions retain only the general outline and some fragments. (From Donald Johnson, *Essentials of psychology*, McGraw-Hill, 1948)



has shown that even estimation of the distance of an aerial target improves with corrected practice.² This kind of perceptual improvement does not transfer much from one situation to another, so the best practice is practice under conditions similar to actual operating conditions.

In some situations perceptual errors persist because convincing correction of errors is not possible. The moon always looks smaller and closer than it is because there is no corrective comparison. Illusions of weight can be temporarily established by manipulating the perceiver's practice in lifting and judging the weights.³ And, in reverse, the magnitude of an illusion can be reduced by repeated trials⁴ (see Fig. 7.2).

Adults in our culture make much use of straight lines, circles, squares,



Fig. 7.2. Effects of perceptual practice on an illusion. The Müller-Lyer illusion is measured by comparing estimates of the distance between two points when arrows enclose the distance and when the arrows are inclined backward, as in the upper right corner. According to this subject's estimates, the illusion decreased irregularly with repeated trials and also during the overnight interval (broken line) between trials. (From Köhler and Fishback⁴)

cubes, spheres, and such regular geometric figures, and an irregular figure may be seen as an imperfect circle or "a circle with a little bulge." Likewise, after we become familiar with horizontal floors and table tops and with vertical corners and posts, we construct our notions of space in reference to an imaginary horizontal and an imaginary vertical and locate objects within

these coordinates. This is a highly civilized achievement which takes considerable practice. A young child of five or six, if asked to draw a house and trees on the side of a mountain might draw something like Fig. 7.3, but a child of nine is more likely to draw one like Fig. 7.4.

Even the achievement of a straight line as a regular geometric pattern



Fig. 7.3

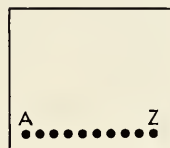


Fig. 7.5

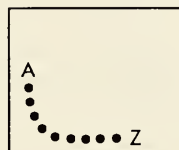
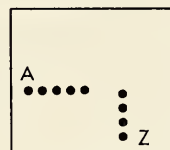
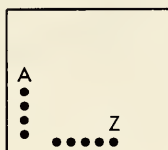


Fig. 7.6

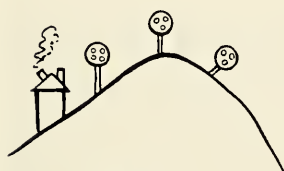


Fig. 7.4

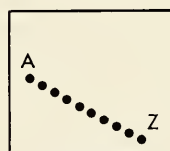


Fig. 7.7

Figs. 7.3-7.7. Children's drawings. (Redrawn from Piaget and Inhelder⁵)

differentiated from the particular background requires several years of development. This can be studied with the help of matches stuck in plasticine to look like posts. Two of these are placed at A and Z, as in Fig. 7.5, and the child is asked to place the others between them so as to make a straight line or a straight road. Young children of five or six can do this fairly well if the line lies along the edge of the table as in Fig. 7.5. If the line has to cut across a corner, it is much more difficult, and broken or curved lines are often made, as in Fig. 7.6. Around age seven most children can put the posts in a straight line regardless of the background in which they are embedded, as in Fig. 7.7, and they do it by sighting along the two end posts to see which intermediate posts are out of line. These perceptual achievements, like most others, are mastered with the aid of goal-directed actions, such as sighting, moving the head to another point of view, drawing, and gesturing.⁵

Thus, anyone who has had eyes and ears open for many years has usually achieved a stable cognition of the environment. He knows the location of important things and paths from one to another, usually in reference to imaginary horizontal and vertical axes. He can identify objects of interest and differentiate them from their backgrounds and from one another. He can estimate heights, weights, temperatures, et cetera, at least in familiar

situations, with fair accuracy. He perceives danger in a scowl and in slippery ice. He perceives warmth in a smile and in brown buttered toast. Except for contours, brightness and color differences, and the primitive differentiation of figure from ground, these cognitive achievements are the results of active give-and-take relations with the environment.

In addition to individual differences in perceptual skills, due to inherited aptitudes and to practice, there are individual differences in the perceptual organizations that people achieve. Girls, for example, make many differentiations among clothing fabrics that all look alike to boys. And the average American boy makes many perceptual identifications in the world of automobiles that are not perceived by his sister. Likewise, when a farmer looks at a pasture, what he sees is not what the landscape painter sees, for different perceptual organizations are often learned by daily practice in different occupations.

MOTOR SKILLS

Much of a person's development is due to the learning of movements or motor skills, such as learning to manipulate a knife and fork, to dance, to write, to handle tools and operate machinery, to pluck eyebrows, to play games of skill and musical instruments. "Motor" is an adjective referring to movement or response, as when we speak of motor nerves, but motor skills could also be called sensorimotor skills because the things that are learned are not merely responses but responses *to* sensory stimuli, coordinations between what is perceived and what is done.

Some of the simplest coordinations are learned by conditioning, and perhaps some complex coordinations also, for conditioned responses may be chained together in a series so that a response is a stimulus for another response. Much motor learning is selective learning also. The child holds his knife one way the first time, a little differently the next time, still differently the next, and so on. The grasp that is most often reinforced by success will be practiced and retained. Irrelevant, accessory movements are likely to be eliminated in time. Social interaction also enters into the learning of many motor skills for the learner may be instructed by others or may imitate others. Mothers have much to say about how their children hold their knives and forks. Even when guidance is available, however, everyone must go through a certain amount of trial and error for himself, aided by transfer from similar tasks.

Many motor skills are largely inhibitory. Toilet training consists of learning to inhibit reflex action of certain muscle groups or to control them until an approved time and place is reached. Tension in the bladder, for example,

relayed by receptors in the bladder walls (see p. 89), becomes a signal for inhibitory control of the sphincter muscles. But this control is much harder for some to attain than others, especially when asleep. Bed-wetters sleep through this stimulation, so the practical problem is to make the bladder tension an effective stimulus for waking, and the classical conditioning procedure has been used for this purpose with promising results. A pad is placed under the child and suitable electrical connections are arranged so that when the pad becomes damp a circuit is closed which rings a bell. The bell, S_m , wakes the child, and he is taken to the toilet. But the bladder tension always precedes the bed-wetting—that is, it acts as S_e . It gets conditioned to the waking response so, if all goes well, the child wakes up *before* he wets the bed.⁶

Other experiments have demonstrated that children can learn to control fears, like fear of the dark and fear of animals, as by reconditioning and by imitation of older children. However, learning to do nothing is always difficult, and especially so in a threatening situation. It is easier to learn to do something else, e.g., to find a ball in the dark or to pet the threatening animal, that is incompatible with the emotional response.

Another motor skill of considerable importance is relaxation. If muscular tension does not return to normal after emotion and other stresses have passed, it is possible to practice relaxation deliberately. It is not necessary to buy expensive equipment or to lie on the beach. Grip the bottom of your chair with both hands and pull, noting the sensations in your arms, back, neck, and shoulders. Then stop pulling and note the difference in kinesthetic sensations. Clench your jaw muscles, scowl, and tighten your facial muscles; then let everything sag and note the difference. If you practice this tightening and loosening of the muscles of the body, you may learn to perceive where the tension is and acquire the muscular control to turn it off. You will probably notice as you practice the exercise that practice consists in concentrating or controlling attention as much as anything else, so it is best to begin where there are few distractions.

Higher Units. As motor learning progresses, speed and accuracy usually increase, and amount of effort decreases. When the skill is a complicated one, as in typing the word “ever,” a simple coordination, like seeing *e* and hitting the *e* key, soon becomes telescoped, as practice proceeds, into the next S-R unit, seeing *v* and hitting the *v* key. The process starts out like this:

See *e* → Hit *e*

See *v* → Hit *v*

See *e* → Hit *e*

See *r* → Hit *r*

But these eye-hand coordinations soon overlap like this:

See $e \rightarrow$ Hit e
 See $v \rightarrow$ Hit v
 See $e \rightarrow$ Hit e
 See $r \rightarrow$ Hit r

And still later the word is seen as one pattern of four letters, and the four keys are hit in a smooth well-integrated pattern of movements:

See "ever" \rightarrow Hit "ever"

The learning of any complicated pattern of movements, like flying an airplane, playing a one-man band, and talking, necessarily involves the mastery of such *higher units* of response or habits. Learning is not complete until these higher units are organized into a system of acts, a habit that can be started or stopped, speeded up or slowed down, as a whole, as a flexible instrument at the service of any motive. In reading aloud, for example, the speech is geared to the perception of the words, but it is a fluid or hydramatic sort of gearing in which the voice may follow close behind the eye or lag several words back. This *eye-voice span* can be noticed when the reader continues to read evenly while turning a page, or it can be demonstrated experimentally by shoving a magazine between the reader and his book and counting the number of words he reads after his vision is interrupted. If he is a good reader, he will continue for five or ten words.

Another sign of the flexibility of a well-learned higher unit or response pattern is that it may be guided by different stimuli. In learning to type one first watches the keys, but as practice continues, information from tactual and kinesthetic senses replaces vision, perhaps by simple conditioning, freeing the eyes for other duties. Many skills are initially practiced as responses to visual stimuli but later become responses to kinesthetic stimuli—and the learner is then likely to say that he "can do it with my eyes shut" or that he has "the feel of it."

Maturation. Not all improvement in motor skills is due to learning, for some achievements, like walking, appear at a certain age with relatively little practice. Their development depends more on maturation than on practice. Maturation was discussed briefly in Chapter 1 and can now be integrated with information from the previous chapter on the relation between rate of improvement and limit of improvement. In general, maturation raises the physiological limit so that a given amount of practice produces a greater amount of improvement. Fig. 7.8 A represents the case of an immature organism in which the physiological limit for a certain skill is at zero. Practice would produce no improvement at all. Reading at age three might be an example. Fig. 7.8 B represents the case of an organism at the critical age when maturation has raised the physiological limit slightly. Large amounts of practice are required for a small improvement, and the

learning curve is a short flat one. Fig. 7.8 C illustrates a tall thin learning curve, which is obtained when the organism's capacity to learn this skill has matured so that the same amount of practice will produce a large improvement.

Individual Differences. In general, men and women do equally well on motor skills if motivation and practice are equal, except that women are handicapped on tasks that require handling heavy tools. Older people are handicapped on speed tasks.

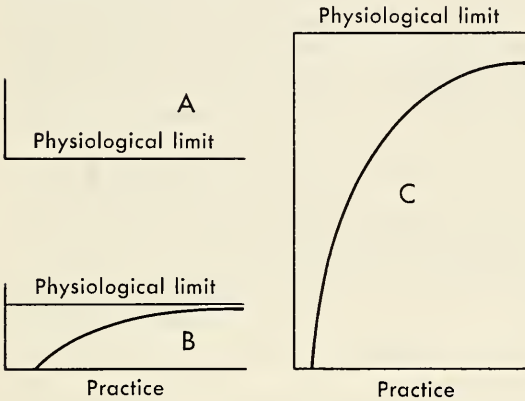


Fig. 7.8. Motor learning and maturation. A represents the case of an immature organism unable to perform a certain activity and therefore unable to improve with practice. One might locate the physiological limit at zero. B represents the case of an organism at an intermediate stage of development when maturation has raised the physiological limit slightly and a large amount of practice will produce a small improvement in skill. C represents a mature organism in which the limit is high and a relatively small amount of practice will produce a high level of performance.

As a rule, motor abilities are fairly independent. That is, a person who reaches a high level of achievement on one motor task may or may not reach a high level on another. He has to be tested separately on each. But it is possible after considerable statistical analysis of the scores that people get on various tasks to group tasks together that require similar abilities.⁷

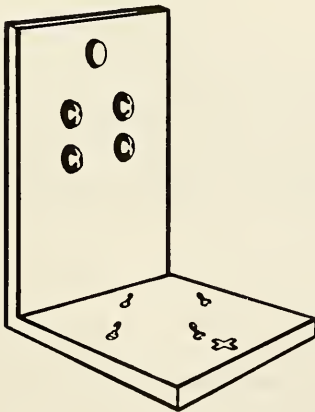


Fig. 7.9. Discrimination reaction. When a light comes on, the subject pulls the corresponding toggle switch as quickly as possible. (Figs. 7.9-7.12 from Fleishman⁷)

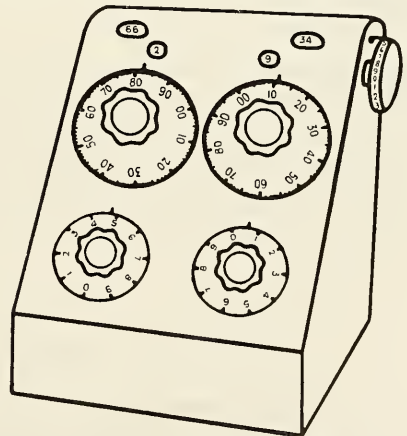


Fig. 7.10. Dial setting. Numbers appear in the openings, and the subject must match the dials to the numbers as quickly as possible.

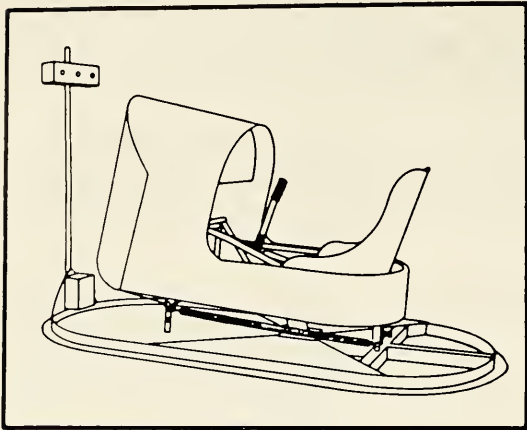


Fig. 7.11. Rudder control. The subject sits in a mock airplane cockpit, which he attempts to keep lined up steadily with one of the three target lights. As he shifts from one light to another, his own weight throws the seat off balance unless he applies and maintains proper correction by means of foot pedals.

One such ability, called response orientation, is the ability to make the correct movement to the correct stimulus rapidly when there are several possibilities. It shows up in performance on the apparatus shown in Figs. 7.9 and 7.10. Another, called fine control sensitivity, is the ability to make precise, highly controlled adjustments, as in pursuit learning, illustrated by Fig. 6.7 of the last chapter, and the more complicated adjustments required by the apparatus of Figs. 7.11 and 7.12. A third important ability, called multiple limb coordination, is involved in any task that requires integrating the movements of hand and foot or two of each. Others of less importance are simple speed of reaction and steadiness. These motor abilities, as analyzed in adults, are due mostly to years of practice in making movements of various kinds, observing the results, and correcting for errors. Inherited capacities may also be involved as well as anatomical differences in bones, muscles, and nerves.

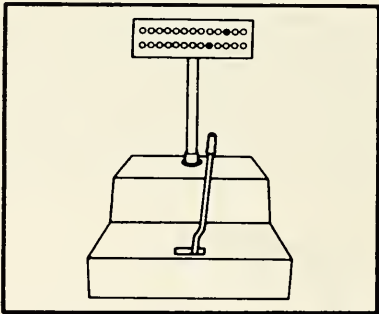


Fig. 7.12. Control adjustment. The subject is required to match the position of a red light with a corresponding green light controlled by a highly sensitive control stick.

PRACTICE PROBLEMS

1. One frequently perceives a cavity in a tooth as much larger than it is. Why is this perception not learned more accurately?
2. What is wrong with defining an illusion as a false perception?
 - a. Some illusions are correct.
 - b. The procedure for calling it false is not specified.

- c. Some illusions are eventually accepted by everyone.
 - d. All perception is partly false.
3. Does the general slope of the curve of Fig. 7.2 indicate positive acceleration or negative acceleration?
 4. Describe a situation in which the conditioned-reflex treatment of bed-wetting would be ineffective.
 5. Why is operant conditioning not used in the treatment of bed-wetting?
 6. By analogy with the eye-voice span, what would the ear-hand span be?
 7. Why is perceptual learning likely to be incidental learning?
 - a. One learns to perceive while engaged in other activities.
 - b. Feedback is immediate.
 - c. Perceptual learning is not motivated.
 - d. Much perceptual learning is illusory.
 8. What has science contributed to learned perceptual achievements?
 - a. Increased visual acuity.
 - b. Lower threshold for color vision.
 - c. Vertical frame of reference.
 - d. Scales for estimation of magnitudes.
 9. Is it true that perceptual learning reaches a physiological limit about age nine?
 10. Sex differences in motor skills are due chiefly to differences in motivation. True or false?

VERBAL ACHIEVEMENTS

How much is 2 and 2?

How do you pronounce *pensée*?

Who did the first experiments on memory?

What is the atomic weight of sodium?

What is the opposite of *transparent*?

What is Leslie's telephone number?

These questions illustrate another large class of learned achievements. Adults are different from children largely because they have been around longer and have picked up more odds and ends of information, more names and numbers. Much of this learning takes place in school, motivated uncritically by social approval and achievement. Later learning is more selective, and one learns the facts, words, names, numbers, and labels that are useful, or promise to be useful, in daily work, or in conversation, or to support a political argument. Our friend Mr. Stone has a wide range of information about the jewelry business, as one might expect, but he can also name almost any kind of dahlia and can estimate the odds of getting a full house with deuces wild. He knows nothing about collecting stamps and probably never will. If isolated facts and names are not organized in some meaningful way, forgetting due to retroactive interference is a constant possibility.

Vocabularies

One of the most impressive achievements of human beings is a supply of words, a vocabulary. Acquisition of an *active vocabulary*, the words one uses, means learning a complex motor skill that includes precise control of the tongue, lips, and other muscles. English-speaking people, for example, use about 40 speech sounds, combined and delivered about 12 per second according to standard usage within the culture. Ability to make these elementary sounds matures in the first few months of life; the first part of the learning consists of making these sounds in appropriate social circumstances, probably by operant conditioning. During this critical period, around three months, the vocalization rate is increased by immediate social reinforcement (the experimenter leans over the crib with a broad smile, makes three “tsk” sounds, and tickles the infant’s abdomen) and is decreased by withdrawal of this reinforcement^s (see Fig. 7.13). The second

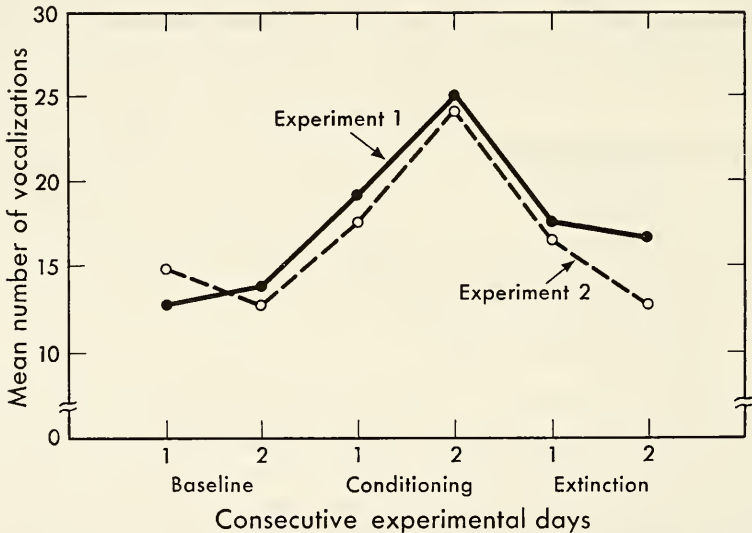


Fig. 7.13. Social conditioning of vocalization. The baseline vocalization rate of infants of three months was observed on two consecutive days, then for the next two days each vocalization was reinforced by social interaction, such as tickling and smiling. On the fifth and sixth days no special reinforcement was given. The graph shows the rise due to conditioning and the fall due to extinction for two experiments, 11 infants in each. (From Rheingold, Gewirtz, & Ross⁶)

part of the learning is discriminative conditioning. Babbling in his own delightful way, the baby makes a variety of sounds, including something, let us say, that the alert parent can recognize as “wa-wa.” So the baby gets a drink of water, and the habit of saying “wa-wa” under these conditions is reinforced. Similarly, other sounds are playfully produced and reinforced

by tactual stimulation, feeding, and other pleasant social interaction and thus become available for combination into words. Infants all over the world make the same speech sounds at first, but some sounds are not reinforced and these seem to be lost to them or embedded in other speech patterns, so if they later study a foreign language that uses such sounds, the relearning is quite difficult. Thus at age 10 an English-speaking child can pronounce an unfamiliar English word like *soporiferous* easier than a foreign word like *fauteuil* or *fälschlich*.

When the child begins to imitate others, around age two, he practices a wide variety of sound combinations and has great fun at it even though the reinforcement is merely his own enjoyment—just as he enjoys other motor achievements, such as playing patty-cake and standing on his head. The first words he makes are those that only a mother would appreciate, and some of these babyish sound combinations persist if his parents reward him by imitating him or by showing him off to visitors. But when he grows older, he may be ridiculed for linguistic nonconformity, especially when he plays with other boys and girls. One common error of children is broad generalization, using “daddy” for any man and “kitty” for any animal, but dif-

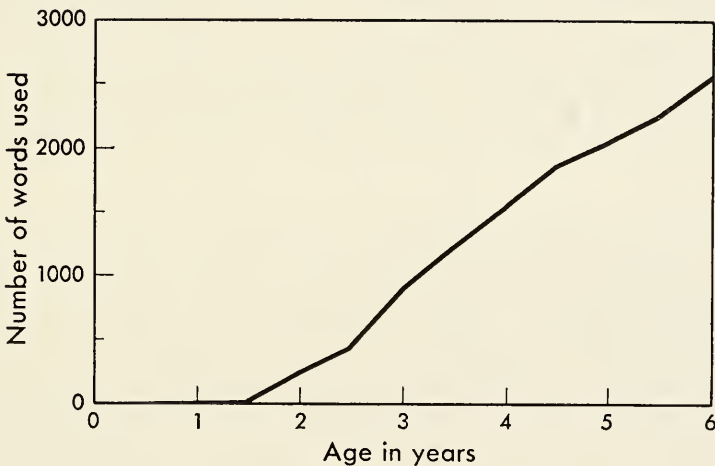


Fig. 7.14. Development of vocabulary in young children. The words were elicited from the children by pictures and questions. (From M. E. Smith⁹)

ferentiation is achieved gradually by differential reward and punishment. Thus, by operant conditioning, selective learning, memorizing, imitation, and other kinds of learning the average child learns in a few years to produce thousands of precise sound patterns in accordance with usage in his neighborhood. Fig. 7.14 shows vocabulary development during the first six years for a group of children somewhat above average intelligence.⁹

The *passive vocabulary*, meaning the words that one understands when

used by others, is probably acquired first by classical conditioning. A word or phrase is heard, then something is seen or tasted or felt, and so, after several repetitions of this sequence, the word becomes a signal for the sight or taste or feel. This can also be called perceptual learning, since it consists of experience in identifying auditory stimuli, grouping them and regrouping them into various patterns, and responding to them in accordance with the standards of the culture.

The active and passive vocabularies are acquired separately at first, just as the dog's barking is separate from his responding to verbal commands, but they come together because the child hears himself talk and he tries to imitate the sounds that he hears others make. The passive vocabulary is always larger, however. The average child of two can respond to a few hundred words, while the average five-year-old has some familiarity with over 3000 of these instruments of communication, and careful estimates¹⁰ place the average for high school seniors above 80,000. It is difficult to determine the size of the vocabulary of the average adult, but 100,000 words would be a fair guess. Estimates of the reading vocabularies of college students run around 200,000 words, which is about 40 percent of the number of words in the unabridged dictionary.¹¹ This is an astounding and uniquely human adaptation to social life. Under most civilized conditions people spend most of their time adjusting their behavior to the words they perceive and influencing the behavior of others by the words they make.

The 200,000 words in the college student's vocabulary are not all learned equally well. Those that occur frequently in ordinary communication, e.g., "table" and "ball," are naturally practiced more than rare words, e.g., "kith" and "shard." Fortunately thousands of words have been counted as they appear in standard reading matter, so if we want to determine whether people are more likely to know "destiny" or "fate," we find, according to one count of a million running words, that "destiny" occurred 17 times while "fate" occurred over a hundred times.¹² Such frequency counts furnish an estimate, for the average adult, of frequency of exposure to different words in the past and, for the child, frequency of exposure to these words in the future. Hence they are used in the construction of spelling books, readers, vocabulary tests, dictionaries (if we wish the definition of a word to be easier than the word defined), and psychological experiments that involve words. The more common words are more readily perceived, as noted above, and are more readily recalled for use in verbal tasks. The more common words are shorter, by and large, than the rare words, and they have more different meanings. If we think of words as tools for verbal tasks, the short words like "set" are handy portable tools, like a pocket knife, that have many uses. Long words, like "translucent," and large tools, like a paper cutter, are more awkward to handle and are used for specialized jobs.¹³

Verbal Relations

If we think of memory as a storehouse or library of words, facts, numbers, and names, we must realize that these are arranged in the storehouse and cross-indexed in many ways. These verbal achievements are acquired and filed at different times in different places but, unlike perceptual and motor achievement, they are relatively independent of the physical environments in which they were acquired and which they often represent. Verbal achievements like words are closely and intricately related to other verbal achievements, and it is this system of interrelationships, often called the verbal environment, that literate people are responding to as often as they are responding to the physical environment. There are several interesting psychological methods for disentangling these verbal relationships.

Verbal Conditioning. The preceding chapter described how the GSR can be conditioned to an auditory stimulus and how the response spreads to other auditory stimuli. Since similarity of the stimuli is so important in this spread or generalization of conditioning, one might ask what would happen if we used a word as the S_c . Is "hot" similar to "cold" or different? This question has been explored by the use of short words as stimuli and the GSR as the response. The S_u was a loud noise, which usually elicits the GSR. Each subject of the experiment was shown a word, such as "won," then the loud noise came, and the GSR followed. After sufficient practice the word alone elicited the GSR, so the subject was ready for the test of generalization.

To test for generalization from the learned word, e.g., "won," to other words, other words of various kinds of similarity were used: similar sound, e.g., "one," similar meaning, e.g., "beat," and opposite meaning, e.g., "lost." The results of this experiment and others like it have proved that children generalize most to words of similar sound; high school and college students generalize most to words of similar meaning.¹⁴ There is a good possibility that verbal generalization of conditioning influences our emotional responses to people's names and other symbols. Remember, this kind of learning does not require a high degree of concentration or intelligence, and other experiments have shown that the GSR can be influenced by subtle verbal relations that the subject does not even recall when the experiment is finished.

Word Association. If you say "Santa" to an English-speaking person and ask him to respond with the first word he recalls, it is likely to be "Claus." This is a rather unusual task for anyone used to coherent speech, but it discloses how words are related before coherent speech is begun. If you say "light," most people will say "dark." Some of these words are associated just because they happen to occur together often, like "Santa" and "Claus," others because they sound similar, like "razzle" and "dazzle." But some are

meaningful, like "light" and "dark," and of course meaningful relations are more prominent in the associations of adults than of children.

These associations influence recall, for better or worse, because when a word is memorized, associations with this word are somehow strengthened and when one is later trying to think of a word, the word he recalls is often a word associated with it.¹⁵ A word is learned in many contexts and thus is related to many other words, and anything that happens to this word may spread to its close relatives.

Hence, when someone is given a stimulus word and asked to give an immediate response word, many associations could be produced, but the association process is controlled by the subject's adjustment to the task, his set. In fact we can often infer from his response words that he started out to be agreeable and give conventional associations, then got bored and gave silly superficial associations. Instead of inferring the set, we can use set as the independent variable and ask our subject to give opposites, or synonyms, or rhymes. Educated people do this easily and switch from one kind of association to another without much trouble, thus demonstrating that the words in one's memory are not permanently associated in pairs, like names chiseled on tombstones. Many different relations have been learned and, under the influence of different sets, they can be activated. If the response takes a long time, we may infer that the habitual response is being blocked or a new relation is being formed, for recall we know is constructive as well as reproductive.

Continuous Production of Words. Another verbal assignment that illuminates how words and facts are withdrawn from the verbal storehouse is called continuous association or continuous production. The instructions are: "Write names of automobiles as fast as you can." Or: "Write names of trees." Most people do this very well, beginning with a rapid rate of production and writing common words first, then slowing down to a trickle as their supply of words in this category is temporarily depleted¹⁶ (see Fig. 7.15). Here as elsewhere the set is quite effective because, of the thousands of words people know, they produce only those that fit in reasonably well with the instructions. We can imagine words arranged in pools or classes, but certainly these classes overlap because after naming trees a person can name words beginning with *a* and some words will appear in both lists. We shall hear of this task again in later chapters under the name of word fluency.

Sentences and Contexts. Conditioning, word association, and the continuous production of words are special experimental procedures that help to describe how hypothetical verbal relations influence observed behavior. Under the more natural conditions of ordinary communication, words, numbers, and facts are arranged in conventional verbal structures, such as sen-

tences, according to standard language habits that children learn when they learn their words. At first the young talker does not really make sentences. Up to 18 months the typical utterance consists of only one word, or an unrecognizable sound like a word, which may be an expression of emotion or a word with the communicative function of a sentence, as when a child who wants someone to bring him a doll says "Doll." By two and a half, sentences of two and three words are typical, and five-word sentences are common at age six.¹⁷ As children master the art of communication in writing, they use longer and longer sentences but, equally important, they use more complex sentence structures with dependent clauses and other sophisticated grammatical devices that they hear and read in the writings of others. According to one count, the average school child at age 14 was writing complex sen-

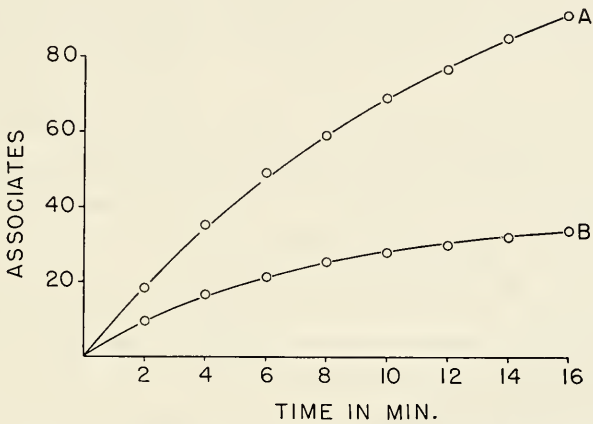


Fig. 7.15. Continuous production of words. College students were asked, in one experiment, (A) to think of names of fellow students and, in the other, (B) to think of animal names with two or more syllables. Rate of production is rapid at first, then slows down as the supply of words is temporarily depleted. (From Bousfield & Sedgewick¹⁶)

tences more often than simple ones.¹⁸ Whatever the motivation to communicate, children learn to put their communications into sentence patterns that conform to standard language habits, just as they drop their unrestrained childish dancing and put their gaiety into socially approved dance forms. This is incidental learning at first, part of the massive socialization process. Later, in school, children study sentence forms seriously, and the increase in precision, sophistication, and complexity of verbal structures continues into college days and even longer for the intellectually active.

Although people often have to struggle to make sentences in conventional grammatical forms, these forms are so familiar that they are easily under-

stood and, if a word or two is misspelled, or mispronounced, or even omitted, the reader or hearer can supply it from the context. For example, in this incomplete sentence, "The lady sat the chair," it is obvious to any talker or listener past the age of eight that the blank should be filled by a preposition or prepositional phrase expressing a relation between the lady and the chair, such as "on," "in," "over," "under," "beside," "in back of," "too far from," and so on. No one would fill the blank with "paper" or "translucent." As an illustration of this function of the context, a 10-word sentence was taken from a children's story about Robert Schumann and printed with the last word omitted: "Rows of black and white keys stared back at ——." When 36 people were asked to supply the tenth word, all 36 guessed right. If we were trying to save words, we could omit that one with no loss of information; and it is this tendency of sentences to include more words than necessary that was called redundancy in Chapter 5. When the ninth word was omitted also, 35 out of 36 supplied "at" and one supplied "from," both guesses being prepositions of the same function in the sentence structure. When more words were omitted, there was more variation in the guesses.¹⁹

A missing word can be guessed from the words that follow the blank as well as from those that precede it.²⁰ Thus in serial tasks like taking dictation, copying telegraphic code, and simultaneous oral translation, one lets his output lag a few words behind the input, so he can guess any missing word from the context on both sides of the blank.

From all this one would predict that if a speaker hesitates and struggles for a word, he is more likely to do so between words that seldom appear together than between words that frequently appear together. To verify this hypothesis spoken sentences were recorded electrically and pairs of words separated by a pause were compared with pairs of words spoken fluently.²¹ As expected, the speakers seldom stumbled between words that occur frequently in sequence, like "at" and "him" in the above sentence about Robert Schumann, more often between words that are rarely paired, like "keys" and "stared."

In summary, then, when anyone opens his mouth to speak or takes pen in hand to write, he does not turn out a random sample of the words in his vocabulary, as if he were reaching into a grab bag. His verbal output is controlled first by his set, for he may be ready to produce single words of any kind or of any relation to other words, or he may be set for connected discourse, whether to inform, entertain, impress, or ridicule his audience. Second, the verbal output is limited by the speaker's vocabulary, for he cannot use words he does not know, and he is more likely to use words that he knows well. Third, he arranges his verbal output in conventional linguistic forms, and these are the instruments of communication and the context within which the single words are produced and understood.

Individual Differences

Differences between one person and another in verbal achievements can be measured with considerable accuracy by objective tests of vocabulary and information, either in general or in special fields. Methods for constructing and using such tests appear in Chapter 11. To test mastery of conventional linguistic forms for purposes of communication, entertainment, or academic conformity, speech and writing tests are required, and these can be graded by competent examiners with fair accuracy if there is agreement on grading standards.

Girls are slightly superior to boys in age of beginning to talk, in length and comprehensibility of sentences, and in all other aspects of language development.¹⁷ The difference is small but it appears when averages of comparable groups are compared in grade school and when vocabulary tests are given to a cross section of adults long out of school. The reason for this difference is unknown.

Verbal achievements, like other intellectual achievements, depend on family background but, in addition to this general influence, the family situation has a special influence on language development. Children in institutions, who do not get much social interaction, are retarded in verbal achievements, even more than one would expect from their general intelligence. Twins, triplets, and quintuplets are also behind the average in verbal development when they are young, presumably because they communicate with each other in their own language rather than with adults in adult language. And, on the other side, children in one-child families are usually advanced because they get extra social stimulation and practice in communicating with adults.¹⁷

CONCEPTS AND PRINCIPLES

The word "concept" is used in several ways, but here it means the class concept or general idea. A person has acquired a *concept* in this sense when he treats many different objects, ideas, or events as members of the same class and refers to them all in the same way. Perceiving the objects shown in Fig. 7.16 he may note, by looking, feeling, hefting, tasting, and other kinds of examination, that some of them are similar in size, shape, taste, density, and so forth. He is likely to put these together in one category or class of objects, excluding others which are noticeably different, and make approximately the same responses, including verbal responses, to these.

Many concepts have names, like "apple." When the concept is thoroughly learned by two or more people, they use the name to refer to whatever it is that all apples have in common, that is, the characteristics of apples in gen-

eral, not the peculiarities of any one apple. Many of the words in an adult's vocabulary are names of concepts like "apple," or more abstract concepts like "loyalty" and "acceleration." We considered words as stimulus patterns in Chapter 5 and as response patterns earlier in this chapter; now we must consider the meanings of words to the individual and their use in communication of information from one individual to another.

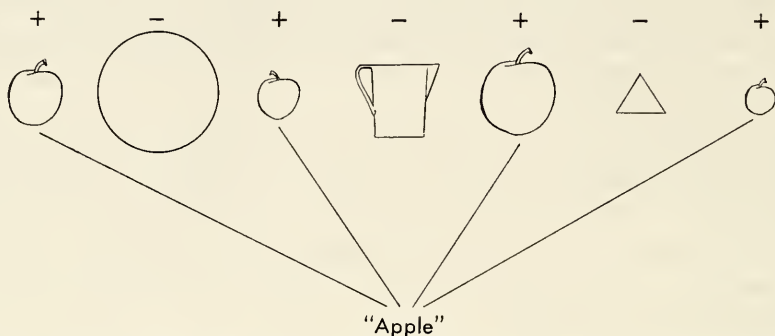


Fig. 7.16. Concept formation. The child hears the word "apple" when he perceives some objects (the ones marked +), but not others. And he is rewarded if he says "apple" when he sees some objects, but not others. Thus he generalizes a concept of apple and differentiates such objects from others (marked —).

How do we know that someone has acquired a concept? How do we know what it means to him? Speaking or writing the word "apple" does not prove that he knows what an apple is and is not. We want to test whether he has a concept and whether it is the standard concept that others have. One test is to ask him to describe an apple, and from his *description* we may be able to determine whether his concept of apple is the conventional one of the dictionary or a private one of his own. When the description avoids details and includes the characteristics of apples in general, we call it a *definition*. The description may also be pictorial, as when a child is asked to draw an apple or a college student is asked to draw a learning curve of positive acceleration. Child psychologists often keep records of the concepts children use spontaneously, or in special test situations.

The other method, which does not require writing or drawing skill, is the *classification* test, which may also be called a test of sorting, grouping, categorizing, or discriminating. Several objects are shown and the child is asked which are apples and which are not apples. At the college level we might show these words and ask which are receptors and which are not: cones, rods, salivary glands, free nerve endings, lens, hair cells. The classification test is also used without giving the name of any particular concepts, as by showing a child a miscellaneous assortment of objects and asking him to "put those together that belong together." If he sorts apples and nothing but

apples in one pile, he must have a functional concept of apple, whether he names it or not. He may, of course, classify the objects by shape, color, attractiveness, or some combination of characteristics, and this variation of the method gives a clue to the concepts he uses when he classifies things for himself.

Together with categories into which things can be classified qualitatively, one learns dimensions, such as size, time, and amount, along which things or events can be ordered or scaled, perhaps measured quantitatively. The average child of nine, we know, can arrange five blocks in order of weight. Tests for younger children ask them to "give me four buttons," or "which is the prettiest drawing?" or "how many houses do you see in this picture?"

These different methods for testing concepts do not always agree exactly. Some people can define operant conditioning, perhaps by memorizing a definition in a book, but cannot discriminate examples of operant conditioning from examples of classical conditioning. And some can discriminate but cannot define, often because they do not talk or write precisely. Those who have mastered a concept completely can use it properly in communication and can apply it to classification and scaling of objects.

One also learns relations between things. In ordinary play the child learns that if he tosses a ball up, it will fall down again. If he slams a door, it makes a loud noise. He does not put these relations into words, but his behavior shows that when the one event happens, he adjusts to the expectation of the other event. Later he will hear many relations expressed in sentences: What goes up must come down. Barking dogs never bite. Such general statements about relations between events are called *principles*. In school he learns many such principles, often stated formally and called laws: $S = \frac{1}{2}gt^2$. Visual acuity increases as illumination increases. Some of the principles that one acquires are rules to guide behavior: Be kind to dumb animals. Look before you leap. Like concepts, principles are generalizations or abstractions from concrete cases. We are not considering any particular object going up or coming down but the relation between going up in general and coming down in general.

We can test for mastery of a principle, as for mastery of a concept, by asking for a description or statement of the principle, or for classification of events that do and do not illustrate the principle. In addition, we can ask for *application* of the principle to explain what happens in new situations. A large part of the study of psychology and many other college courses consists of the acquisition of principles, and therefore the questions on examinations often require the application of principles to new problems. The three kinds of tests for principles, like the two kinds of tests for concepts, do not give exactly the same results.

Acquisition of Concepts and Principles

These abstractions are acquired by several procedures—by simple learning and by the complex intellectual procedures of the next chapter, often influenced by social interaction. The young child does not try to define apple or to classify apples and oranges. While trying to get something to eat, or to play with, or to hide, he perceives and handles an apple and hears the word “apple.” He hears this word again in association with an object of slightly different color and again in association with an object of slightly different size. He may then treat all such objects alike and call them all by the same name. If he says the word “apple” and gets what he wants, this naming is reinforced. If he applies the term too broadly, calling oranges and tomatoes apples, his usage may be corrected either by social disapproval or by failure to get what he wants. This casual or incidental learning from the context in which the word appears is not an efficient way to learn anything, but children get plenty of practice in dealing with common concepts, and when they enter school they have already learned, as a rule, such abstract terms as one, two, three, both, enough, and smaller. In addition to incidental learning children often become intrigued by a word and puzzle over it seriously, as when a girl hears a word used several times and comes to her mother with a question: “Mommy, what is a funeral?” “What is a half?” In school, of course, concept learning is a serious occupation.

In simple cases concept learning resembles stimulus generalization and transfer of training. Another operation that has frequently been observed in concept achievement is *assimilation*. Unfamiliar material is often assimilated or even forced into a familiar category, perhaps with an additional qualifying phrase, as when a child calls an orange a yellow apple and an elephant a horse with two tails.

In the laboratory, when unfamiliar objects are pre-

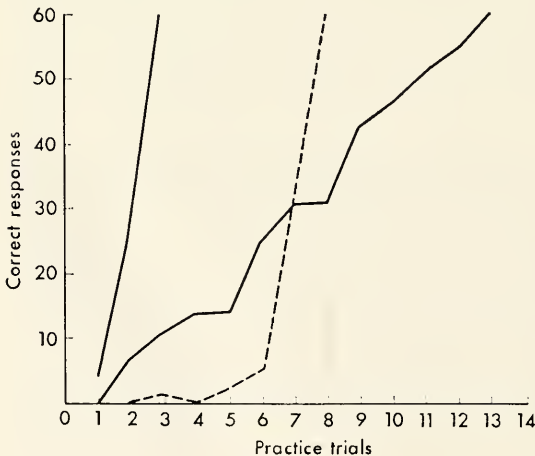


Fig. 7.17. Acquisition curves for concepts. The experiment used 60 cards, each bearing a group of four words, such as “horn,” “leaf,” “monkey,” “debt.” Each card had a name, such as Kun, referring to a class of word groups, which the subjects had to learn. As the curves show, one subject grasped the concept and learned the class names in 3 trials, another needed 8 trials, and one needed 13. (From Reed²³)

sented to college students one after another with instructions to learn their names, concepts are learned much more rapidly than when they are learned incidentally. Also, if the subject is told that similar things have the same name, that is, if he is given a set to discover concepts rather than to memorize names, rate of acquisition increases.²² Likewise, the subject is more likely to discover a principle relating two events if he is actively seeking a principle than if he is just memorizing sequences of events. When anyone puzzles over the difficult concepts and principles in a college textbook, in symbolic logic for example, a variety of intellectual strategies is used, as we shall see in the next chapter.

Under some conditions the acquisition of concepts is like the acquisition of unrelated words and facts, so the practice curve is the typical curve of negative acceleration. Children learn numbers by rote memory at first, with no idea of their relations. But under other conditions the acquisition of one concept facilitates acquisition of the next concept, so positive acceleration might be expected. As a matter of experimental fact, such curves have been obtained in the psychology laboratory.²³ Fig. 7.17 shows curves for three people learning concepts, two of which are almost straight lines while the other is positively accelerated. None of these looks like the typical negatively accelerated curves that describe motor learning and memorizing.

This difference in the shape of the acquisition curve is one difference between the learning of concepts and the learning of unrelated words and facts. The difference in the retention curves of Fig. 6.21 in the preceding chapter is another. Still another difference is one of economy. To memorize 60 words requires far more than twice as much time as is required to memorize 30 words, but to organize 60 words into a system of concepts requires far less than twice as much time as 30 words. After you have learned to conjugate five regular French verbs, learning to conjugate five more is relatively easy.

Difficulties

Many simple things can be learned by anyone who tries hard enough, the chief variable being amount of practice. Concepts and principles, however, are often hard to learn, so we must consider the reasons for the difficulty.

Perhaps the easiest way to conceptualize things is in terms of their attractiveness or pleasantness. Children are attracted to some things and react against other things so they can easily divide up the world into things they like and things they dislike. As they mature, they make finer distinctions and conceptualize a dimension or scale of feeling, extending from unpleasantness at one extreme, through neutrality or indifference, to pleasant-

ness at the other extreme. (For examples of the use of this scale see p. 62 in Chapter 3 and Fig. 7.20 later in this chapter.)

It is easy also to see relationships between things and learn to classify them under one concept if they are perceptually similar. It would be easy to group oranges, apples, and pears together as one kind of object but it would be harder to learn to group peas and tomatoes under the same heading. Children tend to classify things on the basis of superficial, easily perceived similarities before they achieve the more abstract categories of the adult culture. For example, when children were shown 24 miscellaneous toy objects and asked to "put those things together in a pile that belong together," young children of seven grouped things that are often seen together, such as fish, snake, duck, and boat, "because they all belong in water," and things that have a common function, like truck, airplane, and tractor, "because they are all things you travel with." Older children of 11 used more abstract classes, such as animals, humans, and furniture.²⁴ And when we consider psychological concepts used to describe behavior, it is not until high school age that boys and girls make use of abstract inferences and principles tying concepts together, as, for example, in writing about the conduct of a character in a movie.²⁵

Abstract concepts are hard to learn because of their very abstractness. Abstractness in this sense, as opposed to concreteness, means departure from the physical information about an object or event given by the senses. It is not too hard to learn the names of things seen and heard, or to group objects according to some perceived characteristic, such as size or color. Learning to judge the descent of a ball is not very hard either. The difficulty increases when we have to classify and discuss objects or events in respect to abstract or nonobservable characteristics, such as molecular structure, economic value, force of gravity, or metaphysical significance. In psychology, for example, if we are interested in the specific responses anyone makes, we can observe them directly. If we are interested in improvement from one time to another, we must conceive of gain or loss, which is more abstract than a single response and more difficult to grasp. Now if we talk about acceleration, which is an increase in the rate of gain, we have taken another step up the abstraction ladder, and this second-level abstraction is harder to achieve. In one experiment on this point children learned to call rectangles and triangles by new names, such as MEF and YOP, without difficulty, and even when they had to combine these in two classes and call all rectangles DAX and all triangles VIC, 67 percent were able to do it (see Fig. 7.18). But when they had to combine these into a broader, more abstract concept, classifying all DAX and VIC as XIP, only 29 percent succeeded.²⁶ Teachers and textbooks attempt to reduce the difficulty of abstract concepts

by giving concrete illustrations and by differentiating the common characteristics from the irrelevant details.

The task of identifying a common feature in a number of examples is often made more difficult by the pattern in which this common feature is embedded. Many people classify whales among the fishes because their similarities to fish are obvious while their similarities to other mammals are hidden. Living in the water is irrelevant information as far as classification of a mammal is concerned, and experiments have shown that difficulty of concept achievement increases directly with the number of such irrelevant details.²⁷ Here again teachers and textbooks often make concept learning easier by emphasizing or isolating the essential feature of several examples so that it will stand out from the surrounding entanglements (see Fig. 7.19). When the elementary features that are to be grouped together are well learned, it becomes easier to organize them into a concept, or even to break up that concept and organize them into a different one.²⁸ In the case of young children designs are more easily grouped together if they have previously been identified by similar names, such as beem, meem, and peem, than if they have been named jod, daf, and meep.²⁹ Much school learning consists of organizing concepts, then looking at the elements from another point of view and reorganizing these elements into different concepts, narrowing some and broadening others, subtracting

whales and seals from the fish category and adding them to the mammal category. For example, such apparently different phenomena as speech, hand movements, and glandular secretion are all lumped together as responses, while an apparently simple concept like emotion is analyzed into several complex parts.

Concepts and Communication

Whether a concept is acquired by incidental learning or by serious study, its meaning is gradually narrowed through the rewards and punishments of social interaction to that which is current in the culture. Using words as others do is a kind of social conformity, like dressing as others do and driving on the right side of the road. In case of doubt one consults that alphabetical catalog of language habits, the dictionary, just as one consults an etiquette book or a law book to check on the social norms. Simple concrete concepts like apple are used in communication with high conformity, so when one

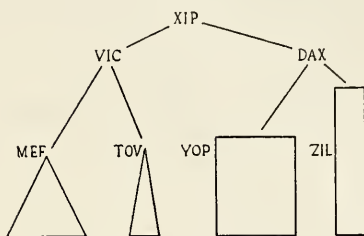


Fig. 7.18. Levels of abstraction. (From Welch & Long²⁶)

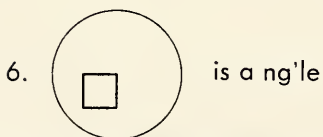
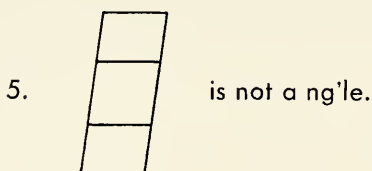
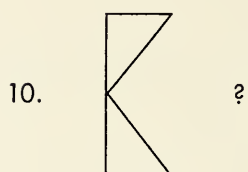
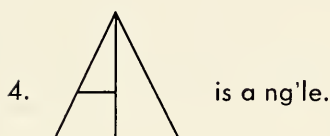
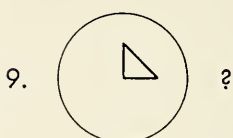
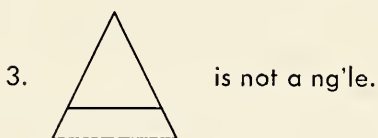
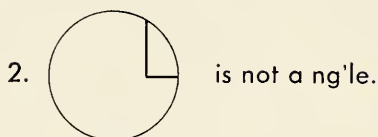
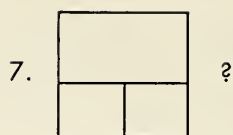
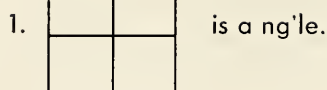




Fig. 7.19. Learning the concept of ng'le. The first six illustrations are presented for practice; the next six are tests. The chief difficulty of this series is that the essential characteristic of the concept, an angle \square inside the figure, is embedded in larger figures and is thus hard to isolate. If No. 12 were presented first, the angle might not get embedded in the other designs and thus might be easier to disentangle from its surrounds. The essential characteristic might be emphasized by heavy

lines  or by isolating it from the  remainder of the figure.

person says "apple" he means what others mean when they say "apple." Conformity in the use of more abstract concepts like normal, sin, and free enterprise, which no one can point to, is harder to achieve.

Conformity and variation in one dimension of meaning, the amount of pleasantness communicated by a word, can be measured with fair accuracy. College students were asked to rate several hundred words on a scale running from extremely unfavorable to extremely favorable in accordance with the impression they make on the reader.³⁰ It can be seen from the graphs of Fig. 7.20, which are drawn to illustrate the feeling suggested by three words, that uniformity of usage is greater for some words than others. Everyone agreed in placing "disgusting" on the unfavorable side of the scale, but they placed it in the three most unfavorable ratings about equally often. For the word "normal" there was a consensus of opinion that it is a

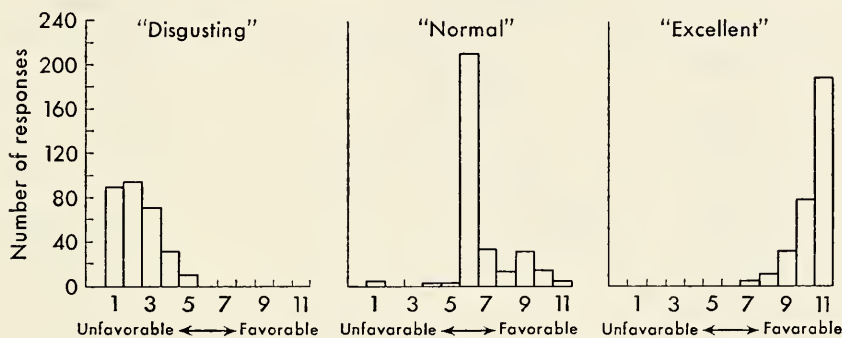


Fig. 7.20. Conformity in responses to words. College students rated the meaning of words on an 11-point scale from unfavorable to favorable. "Excellent" is clearly a favorable word and "disgusting" is clearly unfavorable although there is some variation in the effect of the latter on college students. There is considerable uniformity in the meaning of "normal" but a few react favorably and a very few unfavorably. (Data from Mosier³⁰)

neutral word midway between favorable and unfavorable, but there was a small number of students to whom "normal" connotes something good, and a very few to whom it brings extremely unfavorable implications. To that extent it is ambiguous. "Excellent" makes a clearly favorable impression. One can be sure, when he uses that word in an educated audience, that it will not be misunderstood. Some words that are ambiguous in this favorable-unfavorable dimension are "acceptable," "amazing," "bearable," and "bewitching." This is only one dimension of meaning, of course. When words are rated on many scales and the ratings analyzed, it turns out that the favorable-unfavorable dimension is the most prominent one, but another important one is the potency or strength dimension, as in the difference between "strong" and "weak," and another is the activity dimension, as in "fast" and "slow."³¹ Fig. 7.21 shows how two interesting words, "man" and "woman," were rated on 20 dimensions by college sophomores.³²

When all goes well, concepts are exceedingly useful. It is easy to write or say "apple" when referring to a class of objects, but it would be awkward to be compelled to refer to Object No. 1 of a specific size, shape, taste, and density, Object No. 2 of a specific size, shape, taste, and density, Object No. 3 of a specific size, shape, taste, and density, and so on. When two or more people have the same concepts represented by the same names, com-

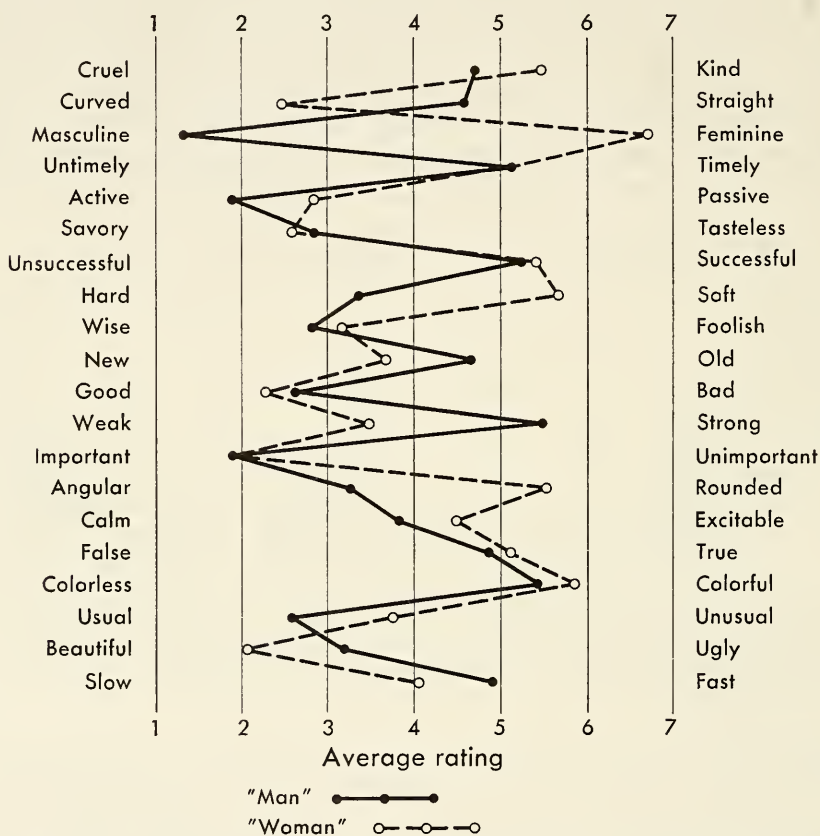


Fig. 7.21. Semantic profiles of two words: "man" and "woman." Average ratings by 15 college men and 15 college women on 20 scales. (Data from Jenkins, Russell, & Suci³²)

munication is greatly facilitated. But when different people use different words for the same concept or one word for different concepts, communication is impeded.

The most serious errors of communication come about when the difficulty of abstract terms is multiplied by the confusing effects of strong emotion. As noted earlier, the good-bad dimension of a concept is learned with ease while the abstract meaning is learned with difficulty. A striking example of such a mix-up is the word "democracy." The labor leader and the manu-

facturer, the American and the Arabian, the editor of the college paper and the dean, all will agree that democracy is wonderful and one will wave the flag as vigorously as the other. One lover of democracy may be referring, however, to the right to strike, another to the right to a fair profit, another to self-determination, and another to favorable public relations. The most inadequate words for precise communication are those which are loaded with good-bad implications and are also abstract. A few of the bad words are: "bureaucracy," "capitalist," "Fascist," "politician," "propaganda," "Red," and "socialism." A few of the good words are: "balanced budget," "education," "free enterprise," "man of the people," "public servant," and "statesman." "Boss" is a bad word; "leader" is a good word.

While most concepts are standard concepts, learned from other people and used in public communication, some are private concepts, constructed and used by one person alone. One child of eight grouped things with sharp corners together and called this class of objects "donas." Some psychotic cases have private concepts and peculiar labels for them. New concepts are invented also by creative thinkers when the old concepts seem inadequate, and these new private concepts may later become standard public concepts.

Not all the troubles of communication can be blamed on variations in single concepts. The forms in which words are strung together, such as modifiers, phrases, clauses, and sentences, are abstractions also, and even though everyone learns to use these forms early in life, by incidental learning, variations in their use produce variations in the information transmitted. As a rule, short sentences, like short words, are easier to read than long ones, and straightforward sentences that go right to the point are more comprehensible than sentences that proceed backward, forward, and sideward, like a ballet dancer, adding elegant variations and literary embellishments along the route.

Flowery writing can be rendered more intelligible to the average reader by prosaic pruning and rewriting—if communication of information is intended. But if the purpose is an artistic one, the communication of a vivid experience, or the arousal of exciting associations, pruning robs the passage of its evocative power. One experiment has demonstrated that variations in the use of a concept are due to just this difference in the purpose of the communication. When college students were asked to respond "as if you were a scientist," 20 percent said the sea is alive and 13 percent said lightning is alive. But when asked to respond "as if you were a poet," 74 percent said the sea is alive and 43 percent said lightning is alive.³³ And when the purpose is simple communication of information, translation of an abstract polysyllabic paragraph into Basic English does not necessarily make it easier to comprehend, for the difficulty may lie in the abstractness of the message as well as the words by which the message is communicated.³⁴

Conceptual Systems

For better or worse, conceptualization continues throughout life. Concepts are formed and regrouped into systems of concepts at higher levels of abstraction and tied together by principles or laws. Thus it turns out that one's cognition or knowledge of the world is not just perception of objects and memory of facts but a structure of scales and categories, a filing system into which sensory stimuli, objects, events, and people are sorted. Once a cognitive system is thoroughly learned, the patterns of stimulation that reach the sense organs are no longer known and responded to only as objects in space. They are known as apples, books, children, dirt, ends, fairies, and so on, to yawns and zebras, some of which are good and some bad. People also, as we shall see in later chapters, are classified as male and female, good and bad, rich and poor. These and other simple concepts are regrouped into smaller numbers of high-level concepts: animal, vegetable, and mineral; federal, state, and municipal; scientific and superstitious. An important consequence of all this for psychology is that the behavior of anyone in relation to an object or event is determined by the category into which he classifies it.

At about this point in the science of psychology the physical definition of a stimulus, so useful in earlier chapters, drops out of use. The stimulus variables that influence the behavior of socialized human beings, such as words, sentences, road signs, weather maps, and actions of other people, are specified in later chapters, not in terms of millimeters and decibels, but in terms of the amount of information they contain, their conceptual significance according to a standard dictionary, or their social significance according to standard observers. Responses also have to be described in terms of their communicative significance, and we shall see that under optimal conditions both stimulus variables and response variables can be fairly well specified in reference to abstract human dimensions.

The things of this world can be classified and scaled according to many different conceptual systems, but when any reasonably adequate system is learned, it is frequently practiced and reinforced. Retention is good. One may forget names and definitions of minerals and animals, but he does not forget that mineral and animal are different concepts. In fact retention is often too good, and many people are permanently stuck with the systems of concepts that they learned in school. Facts are rapidly learned and rapidly forgotten but conceptual systems are hard to change, especially after age 30; assimilation of new facts to old concepts is more comfortable.

Since psychology is a young, active science, its conceptual system is changing continually. All kinds of learning may someday be classified under the concept of conditioning, or under the concept of cognitive reorganiza-

tion, or under some other concept not yet known. Or perhaps the concept of learning will be split into several different concepts. Until recently, psychoanalytic concepts, such as repression, were isolated from the remainder of psychology and treated under separate headings, but today psychoanalytic concepts appear in chapters on motivation or learning or wherever they fit into the overall system of concepts. Forty years from now people will be about the same as they are today, but the concepts used to describe them will be different.

Individual Differences

Vocabulary tests are tests of conceptual achievements if the words are abstract. Other tests ask for classification of pairs of words as same or different in meaning, and for recall or identification of symbols that have a specified abstract relation to other symbols. People who get high scores on such tests usually get high scores on tests of general intelligence and usually get high grades in school.

As to the kinds of concepts that different people acquire and use to organize their knowledge of the world, the general principle is that people learn the conceptual systems of the culture in which they live. Religious, political, economic, and metaphysical concepts vary considerably throughout the world and it is difficult for anyone who has grown up in the United States or any other Western European culture to understand the attitudes of the Burmese or the categories by which they divide up their world—even after learning to read the words they use. Even the categories used in dividing up the color spectrum vary considerably from one culture to another. On the other hand, the categories of modern science, largely created by Western European culture, are being mastered by people of other cultures throughout the world, and, in the other direction, some religious concepts have spread from East to West. Within any one culture there are, of course, smaller variations in conceptual systems, influenced chiefly by family, church, education, and occupation.

People differ not only in the categories they use but also in the emphasis they put on them, and one might expect that a person who develops a strong theoretical value would emphasize theoretical concepts and consider words like “analysis,” “horizon,” “method,” and “museum” as theoretical words. One who develops a strong aesthetic value might consider these four words as aesthetic words, by the same principle. To test this hypothesis we can let people read a list of such words and classify each under the headings used in the Study of Values described in Chapter 3, e.g., theoretical, aesthetic, and religious. Then each person takes this test in the usual way. The results show that people tend to classify more of the things of this world

under the heading of the concepts that they value most, even if they have to stretch their pet concepts to take in the borderline cases.³⁵

PRACTICE PROBLEMS

11. According to Fig. 7.14, at what age does the sharpest increase in rate of verbal development occur?
12. Select the two concepts that together best account for this acceleration in verbal accomplishments: (a) sensory maturation; (b) intellectual maturation; (c) verbal conditioning; (d) word association; (e) memorizing; (f) social interaction.
13. An unabridged dictionary of 2000 pages contains 500,000 words. A test of a hundred words was constructed by taking the first word on every 20th page. Miss Eisner got 42 of these hundred words right. Estimate her total vocabulary.
14. Linguistic experts are fond of quoting sentences such as "Blackberries are red when they are green." What is this sentence intended to illustrate?
 - a. The influence of context on meaning.
 - b. Individual differences in learning concepts.
 - c. Cultural variations in conceptual systems.
 - d. Communication in spite of redundancy.
15. In one experiment on the effects of alcohol on the continuous production of words the subjects were asked to name trees rapidly.³⁶ Would it be the control group or the experimental group that gave responses like "family tree" and "shoetree"?
16. The term "operant conditioning" is an example of concept formation by (a) transfer; (b) incidental learning; (c) trial and error; (d) conditioning; (e) assimilation.
17. Which is the best reason for classifying conditioning in one category and concept learning in another?
 - a. Different motives are required.
 - b. Different aptitudes are required.
 - c. One depends on feedback more than the other.
 - d. One depends on practice more than the other.
18. Three of the following factors are closely related to the difficulty of reading a paragraph. Which three?
 - a. Average sentence length.
 - b. Average word length.
 - c. Paragraph length.
 - d. Percentage of adjectives.
 - e. Number of verbs.
 - f. Percentage of words of low frequency of occurrence.
19. The following table shows four stimulus words and the responses given by three individuals, A, B, and C, under standard instructions. What is the best inference to make about C?

S	A	B	C
book	page	read	Gutenberg Bible
man	woman	boy	Homo sapiens
clock	time	hands	measuring instrument
white	black	black	mixture of wavelengths

- a. C has done this experiment before.
 - b. C is the best educated.
 - c. C is trying to hide something.
 - d. C is set to impress the experimenter.
20. When we spell a name over the telephone, we often say "A as in able, L as in lemon, I as in ice, C, E." This can be described technically as (a) adding redundancy; (b) using familiar word associations; (c) increasing the amount of information available; (d) allowing time for comprehension.
21. Under what conditions is the procedure of Problem 20 most necessary?
- a. Letters are in an unfamiliar sequence.
 - b. Errors in transmission are dangerous.
 - c. Content of message is important.
 - d. Signal-to-noise ratio is low.
22. Why do we not use this procedure for the last two letters?
23. Why is a distinction made between active and passive vocabularies?
24. Which is the more common cause of slow reading in college students, inadequate eye movements or inadequate vocabularies?
25. Which two terms are synonyms? (a) Illusion—perception; (b) motor skill—practice; (c) classify—categorize; (d) association—conditioning.
26. Which two terms are opposites? (a) Maturation—inhibition; (b) necessary—redundant; (c) context—association; (d) concept—fact.
27. In which pair of terms is the second an example of the first? (a) Context—sentence; (b) principle—application; (c) conceptual system—dictionary; (d) active vocabulary—verbal conditioning.
28. In which pair of terms is the second a method for studying the first? (a) Motor skill—learning; (b) concept—vocabulary; (c) association—generalization; (d) principle—application.
29. Which term is different from the others: principle, rule, generalization, law, fact?
30. Vocabulary influences thinking. Thinking influences vocabulary. Which is true: the first statement, or the second, or both?

THE SELF CONCEPT

One concept of central importance for psychology is the concept one acquires of himself, usually called the *self concept* or ego, though ego has other meanings as well. The self concept is not a general concept referring to a class of objects, like apple; on the contrary it is a special concept referring to a very special object. But it is a generalization based on many specific experiences throughout life.

The infant has no self. Unable to make a distinction between himself and the rest of the world, he looks at his toe, and perhaps bites it, just as he would any other object within reach. But when he touches his toe, he receives sensory feedback that he does not receive when he touches his rattle. Sooner or later he learns from this feedback to put his body in one category and other objects in another. Then, about age two or three, he begins the

supreme intellectual adventure: He begins to regard himself as an individual, as a person among other persons, and to learn what kind of person he is. He hears people talk to him and he hears himself talk to them. And he hears them talk *about* him. He sees himself in a mirror. He sees his shadow following him. From many specific experiences like these he constructs a general impression of himself: his appearance, his capacities and limitations, his place in the world, and what is expected of him. The self is more than a habit of interaction with the environment; one differentiates himself from the environment and perceives himself as an object.

Soon after he plays with other children, he classifies them as boys and girls. Because of the name he is given and the clothes he wears, he learns to think of himself as a little boy, like the other little boys—or as a little girl. Because of social approval and disapproval of his behavior, usually accompanied by labeling, he thinks of himself as a “good boy” or a “bad boy.” He learns his position in the family and in school, and later his family’s status in the community. He is told that he is a Catholic, Protestant, or Jew, white, or Negro, Republican or Democrat, and which side of the tracks he lives on. Because of his successes and failures and the reactions of his parents and teachers to these, he conceives himself as one who can do things or one who cannot, and sets his level of aspiration accordingly. When he is young and his self concept, like his other concepts, is not rigidly formed, he can be a bear for a few minutes and then an Indian on a horse. He slips easily out of one self into another, superficially at least. When he grows older, he cannot do this; he cannot easily imagine himself being any other kind of person, and he expects people to treat him as the kind of person he thinks he is.

In general, then, the child gradually ties together the behavior of others toward him and the various kinds of feedback he gets from his own behavior. In addition to this gradual acquisition process he may adopt a ready-made self concept from someone else, just as he adopts someone else’s concept of apple. The boundary between himself and the rest of the world, which the child has learned only recently and not very thoroughly, is easily crossed. When he puts himself in the same class as someone else and tries to act so that others will respond to him as they respond to his hero, he is engaging in what we call *identification*.

In the typical American family boys as well as girls identify with the mother when they are very young because they have more contact with her. Later boys switch their loyalties to the father. The girl will try on her mother’s high-heeled shoes and hats, while the boy will attempt to smoke his father’s pipe and use his tools. This may be more than just a game. Boys and girls can learn all kinds of things, but a boy who identifies with his father will think of himself as masculine and learn masculine habits

and attitudes, whereas a boy who identifies with a female adult is more likely to learn feminine habits and attitudes. And the same for girls. A child learns from both parents, of course, but he learns more from the one he identifies with, usually the parent of the same sex. When boys and girls reach college, research shows that they perceive themselves as similar to the parent of the same sex, and their answers to questions on personality tests are similar to the answers of their parents of the same sex. Outside the family these boys and girls may identify with an older girl or boy, a teacher, or a hero from sports or movies. The more bookish ones may identify with characters in books. When a high school boy is asked what he wants to do when he grows up, he usually does not tell what he wants to do but what he wants to *be*.

All the world's a stage, we are told, and the part a person plays in the drama of life is so important that it has been given a special name, the *social role*. Society assigns a certain role to a physician and expects him to play that role. The social roles of baby-sitters and brides, of policemen and comedians are well recognized, regardless of the particular individuals in these roles. If anyone becomes a policeman, he is rewarded when he acts like a policeman but not when he acts like a comedian. So he begins to act like a policeman and before long he thinks of himself as a policeman. A person's self concept is influenced considerably by the occupation he goes into, but even young children, when they play house, tend to play adult roles as they understand them. Girls usually play mother and boys usually play father, although just what father does is usually not well understood in urban families. But boys know they are expected to be rough and tough while girls are expected to be "sugar and spice and everything nice." Just as one's interaction with the physical environment is controlled by his system of concepts about the environment, so is his social interaction controlled by his concept of his self and his relation to others.

To get some evidence on sex differences in social roles several hundred college students in psychology classes were asked a simple question: "What do you expect to be doing 10 years from now?" The answers were classified in four categories, as follows:

- J Those that mentioned a job only.
- Jh Those that mentioned a job first and home, marriage, or family second. "I expect to have my own advertising business and a wife and three children."
- Hj Those that mentioned home, marriage, or family first and a job second. "I expect to be taking care of my home and children, but I will probably teach school for three or four years."
- H Those that mentioned home, marriage, or family only.

The large differences in Fig. 7.22 show how the social expectations divide men and women. This difference also illustrates the reciprocal interaction

between the self concept and learning. A girl learns the feminine social role from adults and other girls; then, if she accepts this role as part of her self concept, she learns those skills, inhibitions, interests, and values that fit in with the role and rejects those that do not fit. Sex differences in abilities are very small; it is the difference in social role that differentiates men and women most clearly. Notice also that on this simple question about 15 per cent of the women gave the response that is typical of men.

All this does not mean that the self concept is permanent. Gradual changes occur throughout life, and sudden changes may occur at critical periods. When boys and girls reach puberty, they perceive changes in their bodies and changes in the way they are treated by other people. Adolescent boys

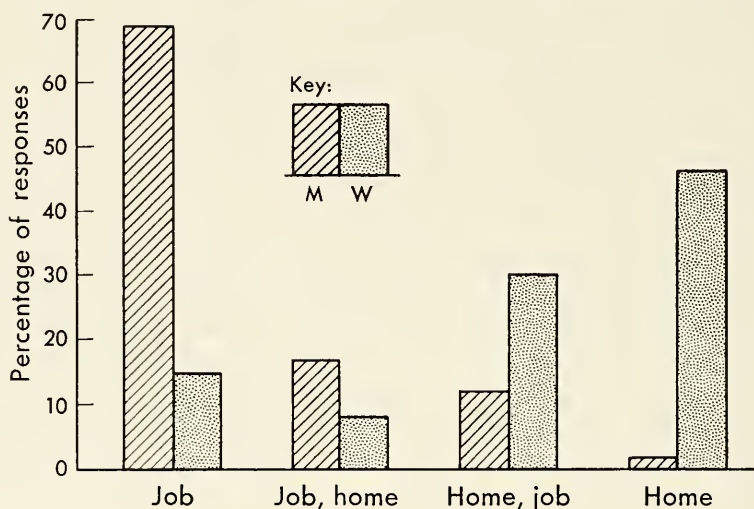


Fig. 7.22. Sex and social role. Several hundred college students were asked: "What do you expect to be doing 10 years from now?" The replies, classified in four categories, show clear-cut sex differences in expectations.

and girls are now rewarded only if they act in accordance with their new social roles. When someone gets a job and supports himself, he plays a different role in society and becomes a different person. When one becomes a mother or father and pushes a baby carriage down the street for the first time, the social feedback forces a change in the self concept. Unemployment, promotion to a responsible job, election to public office, and other occupational changes alter the impressions one makes on other people, and thus the individual alters his own impression of himself. Eventually he shifts his self concept to fit his new social role.

The self concept is not completely dominated by the social role. One may alternate roles or walk through a part without accepting it completely. There was the girl who played the conventional role of a college student though in her secret soul she was a prima ballerina. And there was the

insurance executive who was a poet at heart. In any college class one is likely to observe a student who appears to be primarily playing the role of man about town, mystery woman, playboy, athlete, or other, and only secondarily playing the role of a student. And one can often observe a professor who seems to prefer the role of sportsman, V.I.P., house mother, preacher, or beatnik. The self concept, like other human achievements, is a product of dynamic factors in the individual as well as information from the social situation, and the social feedback is often so ambiguous that, if one tries hard enough, he can interpret the feedback to suit himself and thus build up a self concept more like his daydreams than like social realities.

Methods for study of the self concept are somewhat complicated, partly because everyone's self concept is different. We can ask a person to write a personality sketch of himself, or, in an interview, he may casually describe himself, perhaps by sentences beginning: "I am the kind of person who . . ." or "I would like to be. . . ." Or we can give him incomplete sentences like these and ask him to finish them.

Almost any statement a person makes about himself is related to his self concept in some way because his communications are controlled by his expectations of their effects on others. Unfortunately, we cannot always tell which way the control operates. When someone says he is grouchy, we do not know whether (1) he believes he is too jolly and is reporting what he would like to be, (2) he believes he is jolly but would like to be jollier and is reporting what he is trying not to be, or (3) he believes he is grouchy. We can take advantage of this human ability to adopt different attitudes toward oneself and give our subject a list of statements describing personality and ask him if each describes him as he would like to be (the ideal self), then as he actually is (the real self). Later, by appropriate calculations, we can see how far apart these two self concepts are. Or we can ask him to check these statements as his mother would if she were describing him, or as his wife would.

We would also like to know what one includes in his self concept. Do you consider your hair part of your self? Are your fingernails part of you? Is your notebook part of you? Is your identification photograph part of your self? Are you part of the working class? Are you part of the struggle against sin? Such items can be rated on a circular scale of nearness to the self, as in Fig. 7.23. As one might expect, girls report more self-involvement with items of personal appearance, such as hair and clothes, than boys do.³⁷

The Self as an Abstract Goal

In civilized social life the self concept or ego operates as a goal or value. We can therefore speak of ego motivation or self control as an acquired

motive. When a person goes along in his accustomed grooves, conforming to his own standards of conduct and being treated as he expects to be treated, no ego motivation is aroused. Thirst likewise does not motivate when one has all the water he wants. But when one's self concept is threatened, when a girl is told she looks like a boy, when one who considers himself a radical is accused of being conservative, or when a physician is told he is acting like a ballerina, a strong motivating force is aroused. We can speak not only of fear of being hurt but also of fear of being misunderstood.

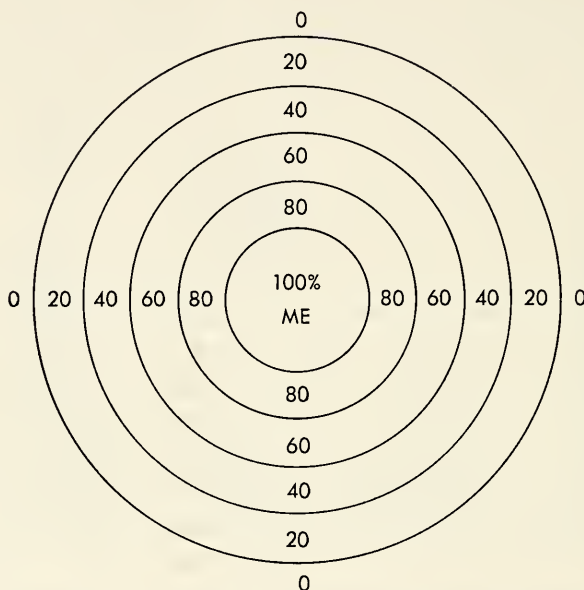


Fig. 7.23. Circular scale for rating self involvement. Where on this scale would you rate: the blood in your veins? blood on the floor spilled from a cut in your hand? your reflection in a mirror? your IQ? your right to vote?

A normal adult likes to think of himself as a special person and will fight harder to defend this concept of himself than to defend the food on his plate or the money in his pocket. "Of what shall a man be proud if he is not proud of himself?" A threat to the self increases general activity, like the other motives, and sets up a pattern of activity in the direction of removal of the threat. The stimulus is a discrepancy between the individual's concept of himself and the feedback that he gets from observing his own behavior and others' behavior toward him. The goal is self-satisfaction, or at least self-acceptance. Behavior is modified until the personal and social feedback seems to fit the self concept. Hence ego motivation acts as a stabilizer, holding the individual to the course that his self concept sets for him.

In a complex social way ego motivation is analogous to the simple homeostatic mechanisms, maintaining the individual in a stable position, as he sees it, relative to his social environment. If the self concept is reorganized, behavior is then stabilized on a new course.

The motivational influence of the self concept is not the same as achievement motivation. Being a boy or a girl is no special achievement, but boys want to act like boys and girls want to act like girls. There is nothing remarkable in being a Catholic, or an Alpha Chi, or a liberal, or a parent, but if one conceives himself as that kind of person, his behavior will move toward that conception. Achievement motivation is upward. Ego motivation is toward one's concept of himself. "To thine own self be true."

Superego

"Superego" is a picturesque term for the motivating force of social disapproval after it becomes thoroughly learned and personalized. The young child inhibits certain responses after he is punished by a parent. Later he inhibits these responses in anticipation of punishment. Still later he inhibits these responses and other similar responses for fear of disapproval by society in general, without reference to any particular person. And finally he inhibits these responses for fear of his own disapproval. In other words, the taboos of society may be conceptualized and included in the self concept or ego. The technical term for this construct that has the effect of saying "thou shalt not" is *superego*. It can also be called the conscience. Whatever name is used, the important fact is that when someone violates the taboos of society, the punishment is often self-punishment.

After all these years of learning, the motivation of socialized human beings becomes quite abstract. The person has organized the world, including the people in it, into a system of conceptual relations, and he has organized a concept of himself located in this social structure. The sophisticated motivation of a socialized individual revolves around his position, as he estimates it, in this social structure, as he conceives it.

SUMMARY

Throughout life we are continually learning, forgetting, and remembering, a lifelong occupation that can be explained with the help of the concepts and principles of the preceding chapter. Much of our learning is perceptual learning, differentiating relevant stimuli and stimulus dimensions from the irrelevant, practicing alternative perceptions before stabilizing on the most satisfying one, and associating signs with what they signify. This perceptual

learning is often aided by movement of the perceiver because movement provides varied sensory stimulation as well as correction of errors. Such learning is aided also by other people, who often identify the significant stimulus variables and often supply the correction of errors.

Just as movement aids perceptual learning, so does perception aid motor learning, whether motor learning occurs by conditioning, selective learning, or imitation. Many motor skills are inhibitory, like bladder control and emotional control. As motor learning progresses, simple associations between S and R are usually integrated into higher units or habits which can then be executed with some flexibility, guided often by kinesthetic information. Rate of acquisition with practice depends on various motor abilities, which develop rapidly during childhood and decline slowly in later life.

Acquisition of the active vocabulary is partly motor learning and partly verbal learning, as acquisition of the passive vocabulary is partly perceptual and partly verbal. Reinforcement is necessarily social. The outcome is a supply of words, some learned better than others, arranged in a network of verbal relations. Because of these verbal relations a response word associated with one stimulus word, by conditioning, memorizing, or other kinds of learning, is evoked by other stimulus words similar in sound or meaning. When people are asked to produce words freely, their output reflects both size of vocabulary and verbal relations.

In ordinary discourse people arrange their words in sequential patterns, called sentences, according to conventions that they learn as they learn the words. In all languages sentences are redundant, so if a few words are missing, the listener or reader can supply them with fair accuracy, using the verbal context preceding and following the blank.

A concept is an abstraction, the common feature of a class of objects, whether it is a public concept standardized by the culture or a private concept used by only one person. In either case the test is a description of the concept or its use, as in classification of objects. Principles or relations between concepts are tested by these methods and also by application to new situations. All kinds of learning contribute to the acquisition of concepts and principles—incidental learning at first, then serious study in school. The chief difficulties are the very abstractness of concepts and principles and the irrelevant entanglements in which the common features are originally embedded.

Standardization of usage of a concept is another example of cultural conformity, in this case one that facilitates communication. Concepts that are undergoing a change of usage and concepts that are loaded with positive or negative emotion impede precise communication. For optimal communication one should respect not only the concept but the conceptual system to which it belongs. Communication between people of different cultures, or

even subcultures, is more than a matter of translation of words; it often involves learning a new conceptual system or ideology.

The most important concept that anyone achieves is his concept of himself. He learns this from interaction with physical objects and other people, especially from perception of others' reactions to his conduct. The self concept is influenced also by any adult with whom one identifies and by any social role that one performs. The self concept changes slowly throughout life, sometimes suddenly, especially with changes in one's appearance, one's job, and extreme success or failure. Most people can, on request, adopt different attitudes toward themselves and thus describe their self concepts from different points of view.

The self concept has dynamic properties because, as it becomes thoroughly learned, it becomes a value to be cherished and defended. A person guides his behavior so that the impression he makes on himself and others will accord with his own notion of himself. Specifically, when the taboos of society have become a part of the self concept, this part is called the super-ego. Thus, after all these years of learning, the motivation of a sophisticated human being revolves around his concept of himself in relation to his concept of the world and the people in it.

PRACTICE PROBLEMS

31. Which conclusion can be properly drawn from Fig. 7.22?
 - a. College men are more frank than college women.
 - b. Our culture puts more emphasis on the feminine role.
 - c. There was more variation in role preference among the women than among the men.
 - d. The variations are due to ambiguity in the instructions.
32. Which of these would be the best guess to explain the results shown in Fig. 7.22?
 - a. The male role is more specialized than the female role.
 - b. Men are more adept at role-taking than women.
 - c. Most women do not understand the society they live in.
 - d. Women are more shrewd in self-analysis than men.
33. We do not list practice as an important variable in learning the self concept because (a) everyone gets plenty of practice; (b) practice is not necessary for this kind of learning; (c) the practice is unmotivated; (d) there is no adequate way of recording the amount of practice.

In Fig. 7.24 line *B* shows the scores for a senior high school boy on the Allport-Vernon-Lindzey Study of Values. He also filled out the form as he thought his father would: line *bf*. Line *G* shows the scores for a senior high school girl, who also filled it out as she thought her mother would: line *gm*. On the basis of these scores mark the following statements true or false.

34. ____ The boy identifies with his father.
35. ____ The boy rejects his father.

- 35. ____ The girl identifies with her mother.
- 37. ____ The girl rejects her mother.
- 38. What facts is the self concept supposed to explain?
 - a. Feeling of loneliness.
 - b. Anxiety in a social situation.
 - c. Dominance in a social situation.
 - d. Control of behavior by environmental stimuli.
 - e. Consistency of behavior.

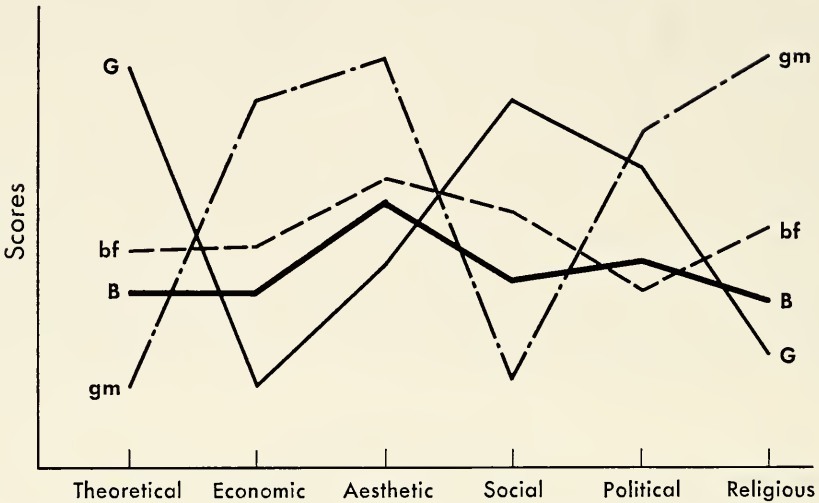


Fig. 7.24. Scores of four people on the Allport-Vernon-Lindzey Study of Values.

Here are eight answers to the question “What do you hope to be doing 10 years from now?” Code them into the categories J, Jh, Hj, and H, according to the discussion of social role in this chapter.

- 39. ____ “My plans are to be married with children 10 years from now with a background of a social work degree.”
- 40. ____ “Hope to be married to a doctor and have four children.”
- 41. ____ “Ten years from now I hope to be working at a good job with the government.”
- 42. ____ “I expect to be a foreign service agent, and married to a woman who is interested in people or other countries.”
- 43. ____ “I hope to be married with two boys and one girl and a good wife, and also hope to be making a comfortable living.”
- 44. ____ “Established CPA with a wife and family.”
- 45. ____ “Successfully raising a well-provided-for family.”
- 46. ____ In 10 years I hope to be a successful landscape architect, earning about \$10,000 a year.”

Label each term C or F to indicate whether it refers to a construct invented by psychologists or a fact of observation.

47. ____ Ego
48. ____ Handshake
49. ____ Superego
50. ____ Scowl
51. ____ Social role
52. One of the concepts of this chapter has been called "the remembered voice of a thousand spankings." Which one?
53. Psychologists often recommend that, if you have to use punishment with children, you should punish the act rather than the child. This recommendation rests on two assumptions. Which two?
- a. Punishment is useless without clear feedback.
 - b. The meaning of the act may not be understood by the child.
 - c. The child can conceptually separate the act from his self.
 - d. Punishment should be consistent rather than severe.
 - e. Punishment of the self should be avoided.
54. Are concepts observables or constructs?
55. One learns the meaning of fish in relation to other animals and in the same way one learns the self concept in relation to _____.
56. "Knowledge of right and wrong has to be learned like anything else." True or false?
57. "People who have heard Russian spoken at home when they were children can learn to speak the language easier when they study it in school." True or false?
58. In respect to learning, which is the greatest difference between man and the other animals?
- a. Man learns faster.
 - b. Man can learn more abstract things.
 - c. Man retains what he learns longer.
 - d. Man is subject to less interference in learning.
59. Man is considerably superior to the other animals in (a) motor learning; (b) perceptual learning; (c) learning inhibitions; (d) cognitive learning.
60. If the data shown in Fig. 7.22 had been collected 40 years ago, would the sex differences have been larger or smaller?
61. Looking at Fig. 7.22 would you infer that it is easier for the average man to learn his social role or the average woman?

Discussion Questions

- A. What important aspects of learning have not been considered in the past two chapters?
- B. Describe the learning done in a college psychology course, using the terms of these two chapters?
- C. How are motives learned?
- D. What do people mean when they speak of "a learned man"?

Recommended Reading

- R. M. Gagne, & E. A. Fleishman. *Psychology and human performance*. Holt, 1959. This introductory textbook has an entire chapter on motor skills, which includes considerable information from recent research by military psychologists.

- D. H. Russell. *Children's thinking*. Ginn, 1956. A comprehensive survey of research on acquisition and use of concepts during the growing years.
- G. A. Miller. *Language and communication*. McGraw-Hill, 1951. A systematic approach to the new science of psycholinguistics, including information about articulation of sounds, perception of speech, verbal habits, construction of sentences, and the social significance of all these.
- R. Brown. *Words and things*. Free Press, 1958. Essays on various problems of psycholinguistics, centered around the question How are words used to refer to things?
- G. Murphy. *Personality*. Harper, 1947. A broad treatment of the achievement of the self and its consequences for later behavior may be found in Chapters 20 to 24.
- B. F. Skinner. *Walden Two*. Macmillan, 1948. Sketch of a modern Utopia in the form of a novel, showing how psychological principles and techniques, especially operant conditioning of children and selective distribution of social reinforcements, can be applied to the shaping of an efficient, noncompetitive, satisfying society.



Baltimore Museum of Art, Gift of Jacob Epstein

Chapter 8. THINKING

The facts of thinking, like the facts of emotion and other psychological topics, come from consciousness, physiology, and behavior. To get at the facts of *consciousness* we can ask, "What are you thinking about?" or offer "a penny for your thoughts," and when we do so people report thinking of words, sentences, images, concepts, goals, events, people, and everything imaginable. This mental activity or stream of consciousness may be idle daydreaming or fantasy, or it may be directed toward solution of a problem. In either case [it is influenced by stimulus factors in the environment, by the achievements of past learning, and by the set.]

There is little specific evidence on the *physiology* of thinking, but we know that thinking, [like other activities, depends on the activation of the organism.] People do not think when they are sound asleep. They do not even dream, except during brief periods when records of brain waves and eye movements indicate an increase in activity level¹ (see Fig. 8.1). [When one thinks of lifting a weight with his right arm, there is a slight increase in electrical activity in the muscles of his right arm, much less of course than when he actually lifts the weight.² The optimal condition for thinking is that mild state of activation that we call alertness, neither drowsiness nor emotional excitement.] [When thinking is directed toward solution of a problem, the solution is observable *behavior*;] hence a large part of the psychology of thinking con-

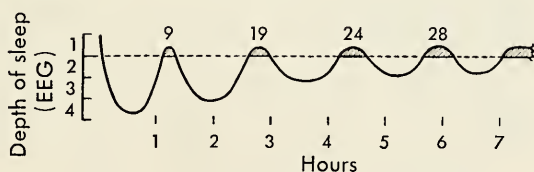


Fig. 8.1. A typical night of sleep. Depth of sleep is estimated by the EEG pattern, as in Fig. 6.12. The shaded areas above the horizontal line indicate when electrodes attached near the eyes pick up signs of eye movements. These occur when sleep is light, and it is during these cycles of light sleep that the sleeper, if awakened, reports that he was dreaming. (From Dement & Wolpert¹)

sists of giving people problems to solve and observing their behavior. [In one sense of the word thinking means solving problems.]

All animals can solve problems, simple problems at least, but man has made problem solving his specialty. Born without wings, he can now fly better than any bird. Extending the eyes and ears he was born with, he gets world-wide news every evening. This tremendous capacity for thought has enabled him to go anywhere on the surface of the earth, several miles down in the ocean, and many miles up in the sky. Furthermore, in solving the problems of life on the surface of this planet, he invented roads, fences, airplanes, alliances, enemies, libraries, and security precautions, and many of his solutions manufactured new problems, especially human problems involving difficulties between people. Everyone has problems, but a miscellaneous list is printed below, by way of illustration.

1. A man and his wife together are 98 years old. He is twice as old as she was when he was the age that she is now. How old is each?
2. Write words and music for a United Nations anthem.
3. Take a man's vest off without removing his coat.
4. As I was going to St. Ives, I met a man with seven wives. Each wife had seven sacks, and each sack had seven cats. Each cat had seven kittens. Kits, cats, sacks, and wives, how many were going to St. Ives?
5. Draw a quadrilateral of such shape that you can draw a straight line through all four sides.
6. Make as many words as you can out of TRANSPORTATION.
7. ADD is to SUBTRACT as MULTIPLY is to _____.

GOLDILOCKS and the THREE BEARS



Fig. 8.2. A puzzle picture. (Courtesy Publication Enterprises)

8. Find the hidden faces in Fig. 8.2.
9. Would it be advisable, under present conditions, for a department store which is the smallest of five in a town of 30,000 to borrow money at 5 percent interest and start an expansion program?
10. This room has it, but the window hasn't.
The floor has it, but not the ceiling.
The wall has it, but not the light.
What is it?
11. A man who wants to send a pair of ski poles by mail learns that postal rules forbid accepting for shipment any article whose greatest dimension exceeds one yard. The ski poles are each four feet long, yet he easily manages to send them by mail.³ How does he do it?

A person has a *problem* when he is motivated toward a goal but his first response is not rewarding. If he is just going for a walk or sitting in a chair daydreaming, he is not oriented toward any problem, and if he goes directly toward the goal, he obviously does not have a problem. Anyone solving a problem necessarily makes a series of attempts, and the conscious thoughts that he reports and the behavior that can be observed will be pertinent to the problem as he sees it. The aim of this chapter is to understand the problem-solving attempts as well as the final solutions.

When we study learning, the chief independent variable is practice, and the learner gets several chances to improve his performance. But when we study thinking, we are not concerned with continued practice but with the production of solutions to new problems. Thinking may follow learning because thinking makes use of knowledge and skills previously acquired. And thinking may precede learning because a response that solves a problem is likely to be repeated when a similar problem is encountered. Thus, during the acquisition of any particular skill, like driving a car, the necessity for thought decreases as performance improves (see Fig. 6.10). Thinking is more like selective learning and cognitive organization than conditioning, of course, but human subjects at the start of any experiment usually try to guess what their role is and what will be counted as a good performance. In general, we call it thinking when anyone is actively trying to solve a problem, but we do not call it thinking after he has solved it once and is practicing to increase speed and accuracy nor when he is responding reflexly or emotionally.)

The solving of a problem is a complex enterprise which includes several operations or processes. No two problems are solved in exactly the same way, but most problem-solving activities can be conveniently grouped under three headings: preparation, production, and judgment—though these activities could be divided up in other ways as well. Preparation means stopping routine activity, identifying the present problem, and getting ready to produce solutions. Preparation for an arithmetic problem, for

example, might consist of putting other things away, opening the book, reading the problem, and getting a preliminary impression of what kind of problem it is. [Production means turning out possible solutions: adding, subtracting, rearranging, trying one approach after another.] After a solution is produced, the thinker may evaluate or criticize it. Is it right or wrong? This conclusive process is called decision or *judgment*.

Thus problem solving has a trial-and-error character. A solution is produced and evaluated. If it is judged "right," the thinker is satisfied and quits thinking. If it is judged "wrong," another solution is produced. And this one is judged "right" or "wrong." And so on. If the thinker produces many solutions and judges them all "wrong," he may turn back to the beginning, reformulate the problem, and prepare to produce a different kind of solution. If he accepts his solution, he may still revise and polish it before he lets it go.

PREPARATION

Consider the problem of Mrs. Stone, who is about to get in the car to go to the grocery. She is planning her purchases while putting on her hat and reaching for the car key in the flowerpot where her husband always keeps it. But the key is not there. She now has a problem to solve. The first or preparatory phase of solving the problem consists of changing her set. She had been thinking of the groceries she needs. Now she gets set to think of places where the key might be. [Problems are solved during relatively brief episodes which begin with the redirection of intellectual activities away from routine things toward the problem and end with the renewal of routine activities.]

Motivation. In this illustration Mrs. Stone's goal is the grocery. The loss of the key is a problem because it impedes her progress toward this goal. Problems and problem solving occur in pursuit of all kinds of goals: food, sex, social success, money, achievement, revenge, or safety. But the motivation may also be intrinsic; the thinker may struggle with Problem 1, not because of any extrinsic reward for solution, but because he likes to work arithmetic problems and wants to get the right answer. Or, to turn the proposition around, one does not work on problems like Problem 2 unless he enjoys music for its own sake. This matter of motivation is not trivial. The person who attempts Problem 1 for social success, because he wants to impress someone, can be distracted by other ways of achieving social success. He may abandon Problem 1 and try Problem 3 or some other parlor trick instead. The person who struggles with Problem 1 because he enjoys playing with numbers would not be distracted by other paths toward social success, but he might be sidetracked into solving some other arithmetic problem or into a discussion of arithmetical relations.

[Self-respect is a goal of considerable significance for problem solving. Loss of self-respect, as by failure on an important assignment, is a problem, and one kind of solution is to produce excuses that make the failure seem reasonable. *Rationalization*, as this kind of thinking is called, may lead to complicated and influential solutions.] The history of thought shows that philosophers have written ponderous theories of government—which students now have to study—in order to make the activities of their monarchs look respectable, and today public relations counselors expend considerable intellectual effort to do the same for their employers.

[Preliminary Survey of the Problem Situation.] When Mrs. Stone was headed toward the grocery, she perceived only those objects pertinent to her progress: door, hat, grocery list, pencil, handbag, etc. But when the problem of the missing key arose, her orientation changed. She now ignores these aspects of the environment and looks back at the room, the flowerpot where the key is usually kept, the shelf behind the flowerpot, and other likely places. She looks at her watch and figures how much time she can spend searching and how long before her husband comes home for dinner. We may say, in general, that she surveys the situation and formulates her problem. She does not look everywhere. She knows where she found the key the last time she lost it. She knows where she usually puts it. She knows where her husband usually puts it. She knows keys do not stick to the ceiling. She uses all these facts and others to guide her search. She is now set to respond, not to everything in the world, but to the problem situation as she has organized it.] The problem takes shape.

[Preliminary Specification of the Solution.] The solution to simple problems may be specified directly by the motivation. If one is hungry, the goal response eating is the solution, but most human problems are not so simple, and part of the preparation is a preliminary identification of the solution or kind of solution that will be rewarding. The solution to Mrs. Stone's problem is well specified because she knows what the key looks like and she will therefore be attracted by small shiny objects. The peculiarity of Problem 4 is that the reader assumes he has to multiply 9 by 9 by 9, then reads on to find that the question specifies something else.

Mrs. Stone got herself into trouble when she lost the key, but frequently it is another person or social agency that sets up the problem and judges the solution, and in such cases preparation includes guessing what kind of solution is wanted. In school, teachers give problems to students and students guess what kind of solutions the teachers want. On the job, the junior architect gets his problems from his supervisor and tries to turn out solutions that his supervisor will approve. The trial lawyer, planning his strategy, works toward a solution that will get by the judge and will influence the jury. We should never forget that most of the problems of human beings

take shape in a social context and that most solutions are socially evaluated. [When problem solving is studied experimentally in the psychology laboratory, many failures occur because the subject does not specify the solution as the experimenter does.] One experimenter set up a problem, which involved rearranging beads on a string, so that it could be solved only by breaking some of the beads. The well-behaved subjects found this very difficult. Likewise, in preparing for Problem 3 people usually assume that they are not expected to cut the man's vest or separate his arms from his body. If these polite restrictions are not included in the specifications of the solution, the problem becomes much easier. (But it can be done without damaging anything.)

Preparation often consists of formulating the problem in some preliminary way. One might begin Problem 1 above by noting that it is an algebra problem with two unknowns. Problem 4 requires a solution that meets the stated specifications. Preparation for Problem 10 might be to formulate it in terms of letters rather than meanings. In the laboratory it is possible to manipulate problems and procedures so that this first or preparatory step can be marked off from the rest of the problem-solving episode and investigated separately. As an example, study these four specifications and then search among the five alternatives for a solution that meets all of them:

FLAT	1. map
READABLE	2. book
DESCRIPTIVE	3. label
GUMMED	4. paper
	5. globe

The apparatus is arranged so that the subject can study the first four words, then turn a switch and select a solution from the other five words, and each operation is timed separately. As one might expect, time spent on formulating the problem increases sharply as the number of specifications increases from 3 to 11 because the thinker has to memorize, or organize, or process the longer lists of specifications in some way before trying to solve the problem⁴ (see Fig. 8.3). This preparatory process seems to be finished before the selection of a solution begins, however, because the solution of a problem of 10 or 11 specifications takes no longer than the solution of one of 3 or 4.

[When the problem requires formation of a concept by discovering the similarities in a number of objects, the preparation usually consists of formulating the problem in terms of shape, color, meaning, or some other kind of similarity, and looking for similarities of this kind.] Fig. 8.4 illustrates a figure-concept problem constructed so that one can formulate the 10 figures on the left in terms of shape or in terms of texture, and find a solution on the right to fit either formulation [Separating the parts of the problem in

this way makes it possible to investigate the conditions that influence the formulation of the problem.] Those who approach problems like Fig. 8.4 just after doing problems that are easily formulated and solved in terms of similarities of shape will formulate this one in terms of similarities of shape

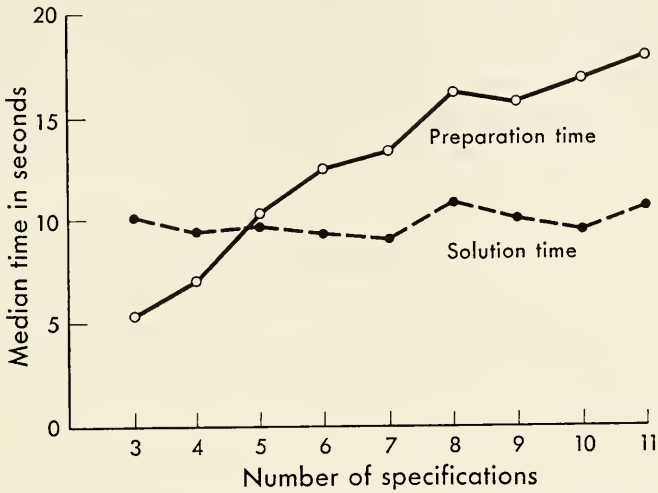


Fig. 8.3. Preparation time and solution time for problems with varying numbers of specifications. (From Johnson, Hall, & Lincoln⁴)

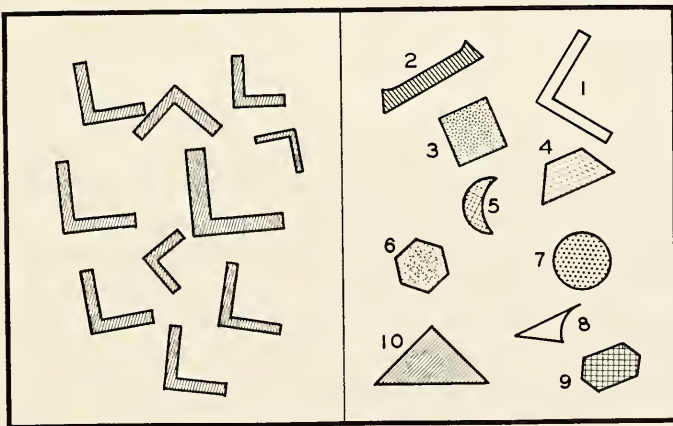


Fig. 8.4. Figure-concept problem. Instructions: "Examine the figures on the left and note what they all have in common. Then look at the figures on the right and find another of the same kind." (From Johnson⁵)

and hence will pick Solution 1, while those who approach it just after doing easy texture problems will formulate this one in terms of texture and will pick Solution 10. [Immediately preceding experience is an important influence on preparation for ambiguous problems of this nature.]

When one formulates a problem in some specific way and then cannot find a solution to fit this formulation, what will he do next? This eventuality has been studied by the use of problems like Fig. 8.4 but with a shape solution only. [preceded by practice on problems that are easily formulated and solved in terms of texture similarities. In nearly all cases the subject formulates the problem in terms of texture and gets set to look for a texture solution, but when he does not find one, he switches back to the left side, reformulates the problem in terms of shape, then returns to the other side and looks for a shape solution.] Usually, of course, the preparatory part of problem solving goes very quickly and the thinker does not realize what assumptions he made when he began.

[Preparation for Creative Thought.] There is no clear-cut difference between creative thought, or creative imagination, and other kinds of problem solving. Such problems as writing a poem, inventing a labor-saving device, and designing a psychological experiment are only slightly different from the more prosaic varieties, and, looking at it from the outside, the essential difference is the novelty of the solution. We call it a creative accomplishment if someone invents a new theory of motivation or designs a new psychological experiment, not if he uses one remembered from a textbook. And, since the solution is to be a novel one, the preparation is necessarily indefinite. The poet may begin with nothing more than a mood that he wishes to communicate. The inventor may merely be dissatisfied with existing door handles and convinced that he can make a better one. [As he works on the problem, the solution becomes more clearly specified, but unless he formulates the problem in an original way, he is not likely to produce an original solution.]

It is at this point that the difference between pure science and applied science becomes clear. [The pure scientist works on problems that have an intrinsic interest to him and formulates them in his own way, while the applied scientist is assigned a problem and is told what kind of solution is needed.] The difference between fine art and commercial art is the same, though in neither case is the difference as clear cut as it sounds.

[Adequacy of Preparation.] The preparatory phase of problem solving occurs quickly and may not be noticed, but it is of critical importance. [The person who structures the problem carelessly may produce solutions to the wrong problem.] The person who prepares accurately may produce a correct solution without much trouble. That is why we say that a question well put is half answered.

It is usually worth while to take time to make a preliminary survey of the problem situation and to specify the kinds of solutions needed before starting to produce solutions. Writing down what is given and what is required may help. When working Problem 5, for example, it would be well to re-

hearse the meaning of quadrilateral before trying to draw anything. In one experiment on this point 128 airmen worked one at a time on a problem that required manipulating two out of seven switches to turn off a signal light. Half of them started immediately, and the other half were asked first what they were planning to do, which switch they would throw first, and what they would do next. [The subjects of the latter group approached the problem more systematically, made fewer repetitive errors, and required fewer trials to solve the problem than those who started throwing switches immediately.⁶] It seems that starting right in to produce solutions of one kind blinds the thinker to other kinds of solutions and other possibilities in the situation.

PRODUCTION OF SOLUTIONS

There are many kinds of problems, of course, and solutions to these are produced in many ways. Once a person gets into the problem and starts producing solutions, his behavior may be quite varied and many of the activities described in previous chapters on perception, emotion, and learning may be observed. It is possible, in addition, to describe some important principles that have come out of experiments on problem solving by considering first the production of simple responses, such as words, then the shifting of the production, and finally the manipulation of more complex patterns. The aim is to describe how people attempt to solve problems and the conditions that lead to success and failure.

Producing Ideas

What is a five-letter word that means the opposite of good?

Preparation for this problem is easy since the instructions are straightforward. One begins immediately to produce words and thinks perhaps of "bad." But this is rejected as too short. Then one thinks of "evil." This too is rejected. And so on. To isolate the production process we can rephrase the task to stress production alone—without much preparation or judgment. Name automobiles. Name birds. Name Nobel Prize winners. Name round things that are heavy.

On simple verbal tasks of this kind words, ideas, and phrases are produced rapidly at first, then more slowly, as in Fig. 7.15. [In general, the more common words are produced first, then the rare words;⁷ hence if the solution to the problem is a rare word, more time will be necessary. The rate of production of words in this way is called *fluency*.]

[Naturally these words come out of the memory or store of learned achievements, but the most striking characteristic of performance on such tasks is

that the responses are appropriate to the instructions.] When asked to name birds, people do not name any of the fruits or carbohydrates or automobiles that they might recall. [They react to the instructions by preparing a set which controls selection from their supply of words.] The mechanism is not well understood, but one can control the production of words to fit any specifications that one can understand, either from one's memory or from a given group of letters. Think of five ways to end this sentence: The river flows. . . . Make words out of the letters in TRANSPORTATION. (The curve for production on this task is about the same as Fig. 7.15.) Put a word in the blank that means the same as the other two words: Illumination _____ delicate. The words produced to fit these specifications may not be exactly right, but they will not be entirely irrelevant either. Production is influenced also by the network of verbal relations, associations, and generalizations described in the preceding chapter. After writing "The river flows fast," one is likely to write "The river flows slow," or "The river flows rapidly."

In any case the rate of production of words and ideas is increased by a gay, enthusiastic approach to the problem and is decreased by frustration, anxiety, alcohol, fatigue, and other conditions that reduce responsiveness in general. [The control of production exercised by the set is more helpful when the specifications are definite.] For example, if the solutions to a series of five-letter anagram problems are all names of animals, e.g., pesesh and shoer, a set for animal names is much more helpful than a set for five-letter words. [And we must remember that in social situations people often restrict the specifications further by adding certain taboos and emphases.]

[Another condition that increases fluency of production of ideas is the separation of the production process from the evaluation or judgment process.] Usually people evaluate their ideas as they produce them, but when they are trying to "think of all possible uses for a coat hanger," it appears that it is better to postpone evaluation. When people are instructed to emphasize free production of ideas and forget about evaluating the quality of the ideas—as in the technique called "brainstorming"—or if they have had a course in brainstorming, they produce more ideas that are rated as of high quality.^{9,10}

Interference and Incubation. When an old acquaintance came into Mr. Stone's store one day, he tried and tried to recall the man's name but could not. Later that day, when he was eating lunch, he suddenly thought of the name without effort. [Apparently the attempt to recall produces some interference that blocks production of the right word; then as the set is relaxed or diverted to other things, the interference may be extinguished.] Or perhaps just a change in tension level or freedom from distraction reduces the interference. [Hence, if the set to recall persists, even weakly or intermittently, there is a greater probability of recall after lapse of time.] This is a

common phenomenon, familiar to almost everyone, in thinking not only of a name but of solutions to more complex problems. Many poets, artists, scientists, and inventors report something of this sort, often using [the name *incubation*, a figure of speech that suggests they begin to think of an idea, then keep it warm until it hatches out into something worth while.] One poet described it to a psychologist as follows: "First I have a mood, then I get two or three lines. Sometimes I carry those two or three lines around and sometimes not. A sudden stimulus starts the incubation of a poem, whether a mood or a line. A mood may lie fallow from a half-hour to a year, and then it comes back."¹¹

Since incubation or something similar has been reported by so many creative thinkers, one can take advantage of their experience in scheduling problem-solving time. [If one has a difficult problem to solve or a theme to write, it is wise to begin early and make a preliminary attempt at solution, then put it away for a while and come back to it later.]

Revision. [People commonly produce solutions to a problem, then stop and judge them. A solution may be rejected, so production starts again, or it may be accepted. If a solution is accepted, it is frequently polished, smoothed, or revised. Revision is a production process of a relatively minor sort,] which can be observed if one watches artists, writers, or inventors at work.^{11,12}

[It occurs relatively late in the creative enterprise,] as shown in Fig. 8.5, so in scheduling problem-solving time, one should allow a fair share at the end for the finishing touches.

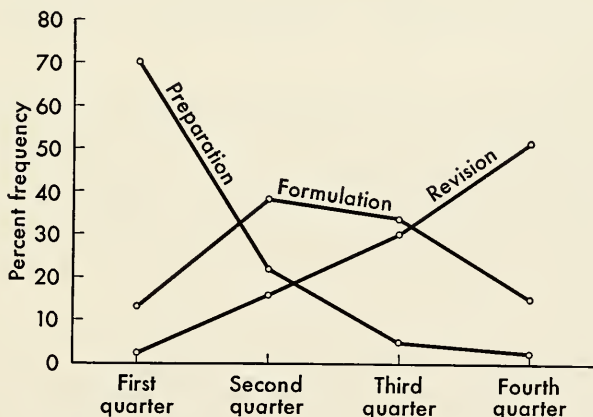


Fig. 8.5. Intellectual activities of poets and artists during four quarters of a creative enterprise. (Data from Patrick^{11, 12})

Shifting Activities

[Though the solutions to some problems may come from straightforward continuous production of responses, usually the production process is more

variable.] After a person thinks of a few responses along one line, he notes that his progress is slow or he observes something more intriguing in the problem, so he shifts set and tries something different. One subject, for example, trying to make words out of TRANSPORTATION, wrote: port, part, pan, pat, past, sport, spot, spit, ran, rat, rap, and so on. Evidently his first approach was to begin with *p*, but after five words with this set, he looked for words that begin with *sp*. After four words of this kind, he shifted to *r*. [He may, as we have seen, stop producing solutions and reformulate the problem.]

Methods of Investigation. In order to investigate shifts in the thinker's set we can ask him what he is prepared to do, what kind of solution he is thinking of, and, especially, to report any change in his operations. This method is limited by the fact that his preparation may be a vague one that he cannot completely describe, and by the difficulty of thinking and talking at the same time. A more objective method is to record the subject's attempts at solution, classify them as types of solution, and note when he shifts from production of one type to production of another. A useful problem for this purpose presents the subject with two lights and asks him to guess which one will be turned on. After he guesses Left or Right, a light comes on, he can see whether his guess was correct, he guesses again, a light comes on again, and so on, serially. If his first 24 responses are RRRRLRLRLRLRLRLRLRLRLRLRLRLRL, we may infer that he guessed R on the first four trials, then tried alternating, then shifted to alternating by pairs. The last part of this series of responses does not reveal any simple pattern, but perhaps if we had a record of the sequence of lights, we might be able to infer what the subject was trying to do.

Shifts of activity in the serial concept-formation problem can be studied by the same procedure. Cards with designs that differ in several features are to be sorted into four piles according to one feature, then another. Sorting on the basis of color is called "right" at first, then, without comment, number classifications are called "right" and the others "wrong." Then the subject has to shift to sorting on the basis of shape, and so on, and after each shift the errors, especially perseverative errors, are recorded.

Another objective method of investigating shifts of set is to arrange a series of problems that requires a shift at a particular point in the series. Here, for example, is a series of letter groups to be rearranged to form common words: [shfi, lemu, rabe, onli, newr, tinu, neve, nalp.] Most people do the first five easily by beginning with the last two letters of each group and making an animal word, thus establishing a set to proceed in this manner. But this approach will not work for the next three, so if these three are solved easily, the thinker must have shifted set after the fifth problem. [If the fourth and fifth are done easily but the sixth and seventh are difficult, the thinker must

have had trouble shifting to the new strategy. Ease of shifting from one activity to another is called flexibility; the opposite is called rigidity.]

Conditions of Flexibility. Many experiments that required shifting from one way of solving problems to another have uncovered some of the conditions that increase and decrease flexibility. The apparent opportunities in the problem situation itself should be mentioned first. If a room has only one door, a person who is trying to escape will keep working on that door, but if there are three doors, he will shift his efforts when the first one disappoints him. [In general, the more promising opportunities people see in the problem situation, the more they shift from one to another.]

Another important factor in flexibility of problem solving is emotional excitement. We have noted earlier that a certain level of activation is necessary for intellectual activity but more intense activation or excitement interferes with performance. The reason is that the excitement reduces a person's flexibility so that, instead of profiting from his errors, he makes the same errors over and over. [Excitement does not interfere with lifting a heavy weight or running a race but does interfere with problem solving when one has to shift from one kind of solution attempt to another.] In one experiment on this point there were two small doors to be opened and the one on the left was always unlocked, yet when 42 college students attempted it, the mean number of trials necessary for solution was 69, and two students failed entirely. Why was this so difficult? Because previously the subjects had been told to find a pattern in the series of designs of various shapes and sizes fastened on the doors, yet they had been arbitrarily punished 75 percent of the time by electric shock in the door handles. After 50 such frustrating trials the simple problem that could be solved by always choosing the door on the left was astonishingly difficult.¹³ [Apparently any kind of stress, threat, frustration, or punishment that raises the level of emotionality interferes with flexibility of shifting set and makes people more rigid.]

The effects of practice on flexibility are complex because three principles can operate. [First, a set to attempt a problem by one method is a habit that is strengthened, like any other, by rewarded practice.] If a person is able to solve two arithmetic problems by a single method, it will be easy for him to apply this method to the next one and difficult for him to shift to a different method. If he is successful with this method on 5 or 10 problems, he will have even more difficulty, research has shown, in shifting to another method. Thus a problem that is easy when it comes first in a series may be difficult when it is preceded by 5 problems that are solved by a different method and very difficult when preceded by 10 such problems.¹⁴ This can be called transfer of training but it is a rigid unadaptable kind of transfer. [Second, shifting itself can be practiced as a higher-order habit.] Series of problems have been arranged so that it is necessary to shift often from one method

Transfer
rigidly

of solution to another, and with this kind of practice one anticipates changes and shifting becomes easier.¹⁵ This is transfer of training also, but at a higher, more insightful level. The shift to another kind of problem should not be introduced too soon, however, because of a third principle, which states that the thinker must master one kind of problem thoroughly before he can detect whether the next problem is the same or different.¹⁶ Hence, under some conditions people trained on variations of a single problem gain more overall proficiency in the solution of new problems of the same kind than people trained on a number of different problems.¹⁷

Analyzing and Manipulating Patterns

[In addition to producing responses to specification fluently and changing activities flexibly, an essential operation in solution of complex problems is the manipulating of relationships, the construction and reconstruction of patterns. The pattern may be the solution itself, e.g., the sequence of movements necessary to take off a man's vest without removing his coat, or the answer to a calculus problem, or an instrumental pattern, like a map, a formula, or an outline, useful as an intermediate step in the solution of a problem.

Wholes and Parts. [A pattern is constituted of parts, but it is different from these parts, just as a concept, which is a special kind of pattern, is different from the particular instances of the concept.] Knowing the digits in the group 2481632 is not the same as knowing the pattern in which they are arranged, and in fact different digits can be arranged in the same pattern: 36122448. One may describe the structure of a sonnet without reference to any specific sonnet, and one can recite a poem without knowing that it has the form of a sonnet. In the same way the pattern of the American middle-class family is something different from the people who make up any particular family.

Certainly [familiarity of the parts is important for problem solving.] Arithmetic problems involving shulahs and planti are harder for school children than problems of the same form involving horses and soldiers.¹⁸ Patterns of logical relations made up of chigs and falten or X's and Y's are harder for college students than the same patterns made up of mammals and bears.¹⁹ But the number or errors due to unfamiliarity of the parts is quite small; many more errors arise from the difficulty of organizing and manipulating the patterns in which these parts are arranged.

Methods of Investigation. How do we know that someone has mastered a pattern and can manipulate it for his own purposes? [There are two general methods, description and use, as for the investigation of concepts.] In the case of the puzzle picture of Fig. 8.2 we can ask the observer to describe

Goldilocks in sufficient detail so that we know he is not guessing, or we can ask him to use what he perceives to answer a question, such as "If she looks straight ahead, will she see the little bear?" If we wish to know whether someone understands the pattern in these digits, 2481632, we can ask him to describe the relationship, or we can ask him to use his understanding to write the next two digits. The string patterns of Fig. 8.6 are so easy for adults that they perceive the important relations immediately, but when young children are asked to pull the string that brings the reward, the difficulties of the different patterns for children of different ages become apparent.²⁰

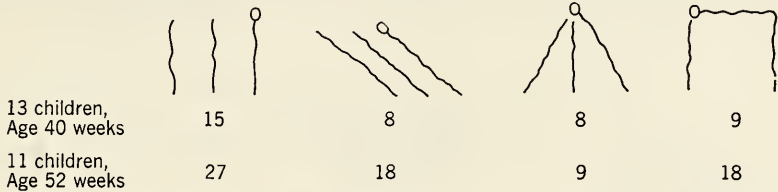


Fig. 8.6. String-pulling problems. Showing percentages of correct first choices by young children. (Extracted from Richardson²⁰)

Remembering the Parts. [Solutions to many problems have to be manufactured by pulling together previously unrelated pieces of information or assembling separate moves into a pattern of moves, and in such cases the difficulty of the problem increases with the number of parts.] When the moves are visible, as in the well-known puzzle that requires transferring disks from one peg to another according to certain rules, the difficulty can be estimated by counting the moves people need to solve it. A problem that can theoretically be solved in 3 moves was solved by college students in 3.5 moves on the average. Another, for which 7 moves is the theoretical minimum, took 24.3 moves. A complex problem of the same kind, for which 15 moves is the minimum, took the average college student 182.7 moves. Thus, when the complexity of the problem, as measured by the theoretical minimum number of moves, increases, the difficulty, as measured by the number of moves that people actually need, increases at a much faster rate.²¹

[Any one part or move may be easy, but in order to organize them in a pattern one must remember the parts at least long enough to orient to them and work on them. People do not usually use all the information available to them, the research shows, either because its relevance to the problem is not noted or because there is just too much to remember.] One experiment on this point required the subjects to discover the concept involved in geometrical designs of various shapes, numbers, and shading when they were presented one every 30 seconds and the subject had to guess at the concept involved in each instance.²² [It is easy to use the information in view, of

course, but when that passes and other instances intervene, the earlier information is often lost. Thus, as Fig. 8.7 shows, the information was retained and used quite well after one or two intervening instances, but after five intervening instances retention was poor and in relation to such information the guesses were frequently wrong. If circumstances permit, one can retain more and more of the information needed by repeated practice and memorizing, and in such cases massed practice is better than distributed practice. For example, college students working on an intricate puzzle of arranging several senators in several hotel rooms according to the rules of protocol did better in 20 minutes of concentrated effort than in 20 periods of one minute each.²³

more
better
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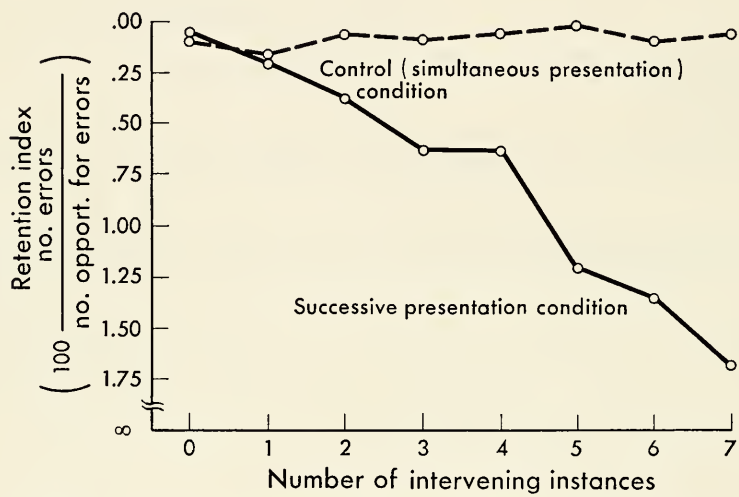


Fig. 8.7. Amount of information and accuracy of concept formation. Figure concepts were presented one every 30 seconds, and when all instances remained in view (simultaneous presentation) errors were few. But when each was removed after presentation (successive presentation), the subjects could retain information from the one or two instances just passed, but information was not well retained after five or six instances had intervened. In respect to remote information errors were frequent. (From Cahill & Hovland²³)

Strategies. [If the problem is simple, the thinker may begin at once and try to solve it in one stroke. If the problem is complicated, with many pieces to be put together, he is more likely to prepare a plan of action or *strategy*.] After the preliminary adjustment to the problem he may carefully prepare, and perhaps write down, the kind of solutions needed and methods of producing them. More often one does not describe his strategy in advance, but it can be inferred from records of his problem-solving activities. A poet's work sheets may show, for example, that he wrote a few fundamental lines to establish the form and later filled in the gaps. [Complex problems are often broken up into subproblems, which are then solved separately.] Another

common observation is that the thinker launches an attack on the problem, starts producing solutions accordingly, then decides his strategy is wrong and prepares a different kind of strategy.

Fifty people working on a complicated problem could use 50 different procedures, and any attempt to describe their strategies in general terms would be hopeless. Actually this does not happen; the problem-solving activities of many people can usually be classified in a few general types. When the relationships within the problem are known to the experimenter,

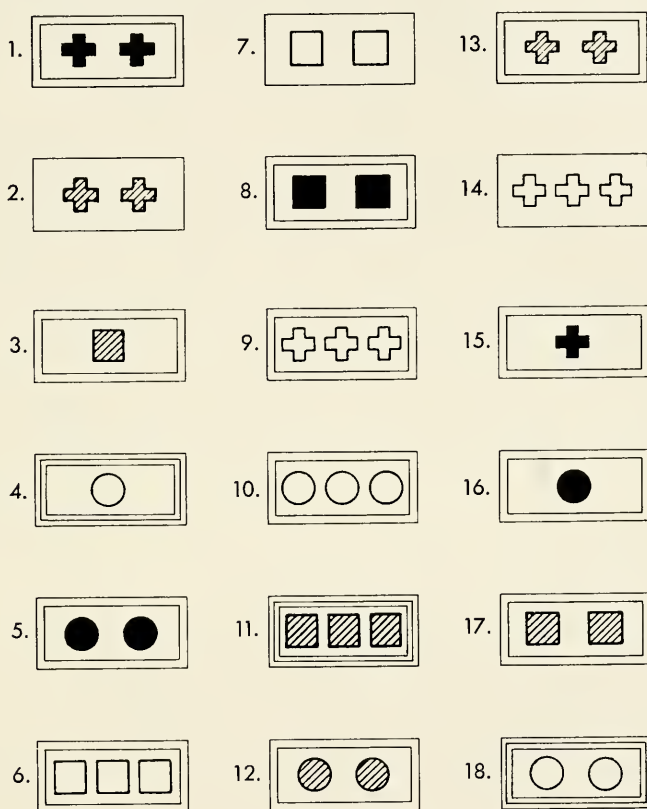


Fig. 8.8. What is it that makes Numbers 1, 5, 8, 12, 13, and 17 right and the others wrong? (After Bruner, Goodnow, & Austin;²⁴ reprinted with permission from John Wiley & Sons, Inc.)

it is often possible to describe logically ideal strategies and see how well these fit the actual behavior. One series of experiments used cards with designs that differed in several attributes, such as color, shape, number, and borders, the problem being to discover the concept—which might be any one or two of these attributes—that is common to some cards and not others²⁴ (see Fig. 8.8). One ideal strategy would be to collect and integrate all the information simultaneously and work out a logical solution. But if the prob-

lem is at all complicated, there is so much information to pull together that this would be beyond the memory capacity of any human being, and nobody really tries to do it. A more feasible and more common strategy is to begin with a hypothesis ("It might be color." "It might be shape and borders."), then to scan the problem material, making guesses that check this hypothesis only and ignoring information irrelevant to the hypothesis. This strategy puts less strain on the memory but has the disadvantage that while testing one hypothesis the thinker is ignoring information that he might use later. Another common strategy in these experiments is to focus on the first design that one guesses right as a whole, then to collect further information so as to see which attributes are not necessary to the solution. One has to have a good guess to begin with, though he may not understand why, and one may improve it by an approximation procedure, changing one attribute at a time. If he is in a hurry, he can change two attributes at once, but then he is running the risk of losing the good focus he began with. Scanning the parts to test a hypothesis and focusing on a whole were the most frequent strategies in these experiments, and in general the subjects, who were college students, adapted their attacks to the nature of the problem, adopting a risky strategy when they had only one try and a more conservative strategy when they had several tries. When the experimenter arranged that their guesses would be right, they began to take more risky strategies. These subjects, like all others trying to discover concepts, preferred a strategy that gave them a positive check on their hypotheses. A negative instance, that fails to support a hypothesis, may be just as informative logically, but few people make use of this kind of information.

The specific strategy will vary with the nature of the problem, but the thinker's behavior is always influenced by amount of information, his capacity for retaining and processing such information, and the risks of error and delay as compared with the prize of successful solution.

Embedding. Some patterns of action, like throwing and catching a ball, are acquired by the integration of simpler sensorimotor habits, just as some simple concepts, like "ball," may be acquired by the gradual accumulation of experiences, perhaps by conditioning. More characteristic of problem solving is the breaking up and reorganization of patterns. A fact picked up in one context at one time may solve a problem when it is torn out of that context and tied in with a previously unrelated fact picked out of another context at a different time. A matchbox ordinarily used as a container may be disentangled from the container context and used as a platform. When one needs a weight to tie on the end of a string as a pendulum bob, one may be able to use a pair of pliers which he ordinarily thinks of in connection with quite different uses. The end of a pencil was merely the place where the pencil ends until someone thought of it as a holder for an eraser. But

breaking up existing patterns and looking at familiar things in a new way is difficult. The principle of embedding, discussed in Chapter 5 and illustrated in Fig. 5.8, states that a pattern whose parts are included in a larger pattern is hard to isolate and manipulate. This principle accounts for the difficulty of the perceptual puzzle of Fig. 8.2, which would be easy if the outlines of Goldilocks and her dogs were not also the outlines of larger patterns.

Arithmetical relations likewise may be obvious, or they may be concealed in larger patterns of relations. If you read that Detroit claims a population of 2,481,632, will you perceive any pattern in these figures? Probably not, but you will if the number is written 2,4,8,16,32. Suppose we want to work out an easy way of finding the sum of any five consecutive numbers, such as 1, 2, 3, 4, 5, or 127, 128, 129, 130, 131. We can always call the first number x and write the series: $x, x + 1, x + 2, x + 3, x + 4$. But that does not make the problem any easier. We have to break up the left-right pattern and see the series as a symmetrical pattern that begins in the middle and goes both ways.²⁵ Then it can be written: $x - 2, x - 1, x, x + 1, x + 2$, and the arithmetic is very much simplified. Perhaps it would have been easier if we had started with a series that is readily perceived as beginning in the middle: 98, 99, 100, 101, 102. The great advantage of algebra for solving problems is that the arithmetic relations can be rewritten in a form that is more easily manipulated to meet the specifications for the solution. For example, $ab - bc$ can easily be broken up and reorganized as $b(a - c)$ if that brings us closer to the solution.

Functional Fixedness. Consider next the problem of supporting three candles on the door at eye level, as for an experiment on vision. On a table lie many objects, including a few tacks and three small boxes of different shapes and colors. The correct solution is to tack the boxes on the door as platforms for the candles. For an experimental group the three boxes were filled with candles, tacks, and matches. For a control group the boxes were empty. The experimenter's hypothesis was that perceiving the boxes used as containers precludes using them as platforms, and, as it worked out, only three of the seven experimental subjects, who saw filled boxes, solved the problem, but all seven of the control subjects, who saw empty boxes, were successful.²⁶ When the function of an object gets stuck or fixed to a specific context, e.g., box as container, so that it is not available for another context, e.g., box as platform, we call it *functional fixedness*.

Most people have seen boxes functioning as containers countless times in the past so this function is well established, but it is also possible experimentally to manipulate the use of an object for one function in the laboratory and thus to build up a temporary functional fixedness against its use for another function. Suppose there are two strings hanging from the ceiling and the problem is to tie them together (see Fig. 8.9). They are so far apart

that one cannot reach them both at once, so the best solution is to tie a weight on one and set it swinging as a pendulum, then walk over to the second string and wait until the first one swings close. Almost any small, moderately heavy object can be used as a pendulum bob, but most objects are perceived as having other functions and are therefore not actually used for this novel function. In one experiment a switch and a relay were available as pendulum bobs, but one group of subjects had to use the switch as a switch in an electrical circuit so, when they tackled the two-string problem, they used the relay. Another group had to use the relay as a relay in an electrical circuit so, when they tackled the two-string problem, they used the switch.²⁷ Functional fixedness, built up by this controlled preutilization in the laboratory, persists and interferes with problem solving for an hour or so, even slightly for a day, but it is all gone in a week.²⁸

What kind of preutilization of an object would not interfere with its later use for other functions? One might expect that utilization of an object for a variety of functions would prevent fixation on one function, and a variation of the two-string experiment was designed to test this hypothesis. A switch was used for turning a light on and off but also for other functions, such as a

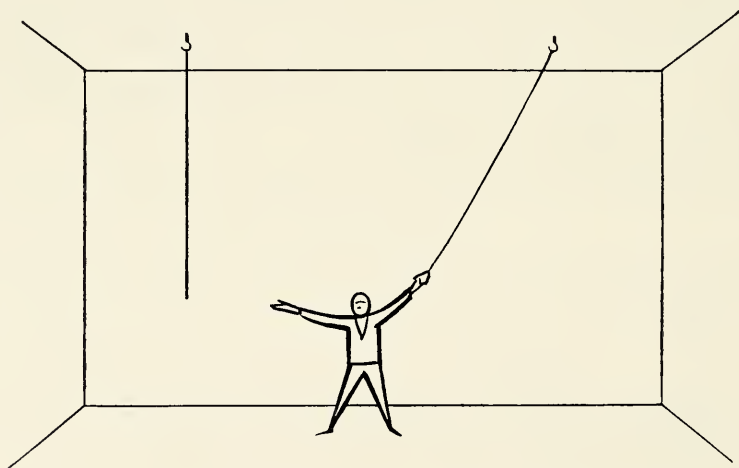


Fig. 8.9. Two-string problem. How can he tie the two strings together?

container for holding pins and a straightedge for drawing a line. One group of subjects used the switch for one of these functions in addition to the usual switch function, another used it for two, and other groups used it for three, four, and five additional functions. Then each approached the two-string problem with both switch and relay at hand. Fig. 8.10 shows that with more variation in preutilization, functional fixedness decreased. When the preutilization included four or five additional uses, no single function of the

switch got fixated and the switch was used for the two-string problem as often as the relay.²⁹

These examples are intended to show that the difficulty of certain problems is the concealment of the solution in a cognitive pattern which is hard to analyze because either present arrangements or previous associations bind the parts closely together in a pattern that is more prominent than the solution pattern.

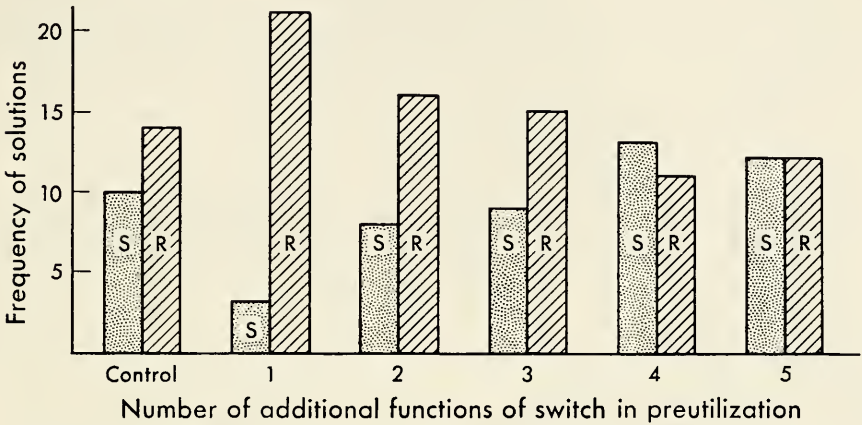


Fig. 8.10. Preutilization and functional fixedness. Six groups of college women, 24 in each group, had to solve the two-string problem, using either a switch or a relay as a pendulum bob. In the control group, with no special experience, each object was used about half the time. In the group that had previously used the switch for another function only three subjects used the switch to solve the two-string problem. But those who had used the switch for several other functions did not become fixated and were able to use the switch about as often as the relay. (Data from Flavell, Cooper, & Loisel²⁹)

Application of Past Learning to Present Problem. Many problems are solved by the application of facts and principles learned in the past, and the person who has not learned these facts and principles simply does not solve the problem. One has to learn simple arithmetic operations before he can solve arithmetic problems. One has to know what a lever can do before he applies a lever to the solution of a problem. But many experiments have demonstrated that past experience is not enough for the solution of some problems, and there are several reasons for this discrepancy. We have seen that there are different kinds of practice and that some kinds make people more flexible and other kinds make them more rigid. Some problems have too much information to be grasped and the thinker has to work out a new strategy for integrating it all. And the information may be initially arranged in patterns that are concealed in other patterns. In general, it is problems of the kinds illustrated in this chapter for which previous learning is not sufficient. More important, the kinds of learning that resemble problem

solving provide the learner with principles and skills that transfer most readily to new problems.* But this is a very general statement. If we study the solution of a particular problem, we find that the usefulness of information given to the subject depends on the amount of information, the kind of information (whether principle or strategy), and the intelligence of the subject.³⁰

PRACTICE PROBLEMS

1. Group the questions together that belong together, and underline the one that is different.
 - a. What are you attending to?
 - b. A penny for your thoughts?
 - c. What's on your mind?
 - d. What are you doing?
2. Do animals think? Answer this question twice, (a) assuming that thinking refers to conscious thoughts, and (b) assuming that thinking refers to problem-solving behavior.

Which of these activities would you call intellectual? Mark each + or -.

3. _____ Classical conditioning.
4. _____ Instrumental conditioning.
5. _____ Daydreaming.
6. _____ Problem solving.
7. _____ Judgment.
8. _____ Perceptual reorganization.
9. Human beings are better problem solvers than other animals for at least two reasons. Pick the best two.
 - a. Superior response capacities.
 - b. Command of language.
 - c. Better sensory equipment.
 - d. Better control over emotions.
 - e. More persistent motivation.
10. Three groups of subjects worked on the two-string problem with different preparatory instructions:
 - a. Use only the objects on the desk.
 - b. Use any object in the room, including the objects on the desk.
 - c. Use any object in the room.

One group solved the problem with an average time of 2 minutes, another 7 minutes, and another 18 minutes.³¹ Which was the 2-minute group?
11. Two groups of 11-year-old girls were given 50 minutes to write stories with this ending: ". . . and that is why the old sailor was allowed to keep his parrot." One group (A) was asked to think about the story for 15 minutes before they were allowed pen and paper. The other group (B) worked as they pleased.³² Which group's stories got the best ratings?
12. Embedding is to functional fixedness as perception is to (a) outline; (b) context; (c) design; (d) use.

* These are the reasons why Practice Problems are included throughout this book. The student is advised to work all problems after first studying the basic concepts and principles of the text.

13. Which question would be best to determine whether someone sees the dogs in Fig. 8.2 or is just guessing?
 - a. Are the dogs constructed of leaves and trees?
 - b. Are parts of the dogs hidden?
 - c. Are they facing each other?
 - d. Are they large dogs?
14. What principle of Chapter 6 would be a good interpretation of the decline of functional fixedness in a few days?
15. The decline of functional fixedness in a few days can be used as an explanation of (a) embedding; (b) incubation; (c) rigidity; (d) transfer of training.
16. After the problem of Fig. 8.11 has been solved, it is obvious that the solution depends on knowing that the diagonals of a square are equal, and the area of a circle equals πr^2 . The contribution of past learning to the solution is suggested by which three of these concepts? (a) Recall of facts; (b) recall of concepts; (c) recall of principles; (d) flexibility in shifting set; (e) functional fixedness.
17. If past learning is not sufficient for solution of the problem of Fig. 8.11, what two concepts suggest the difficulty?
18. The puzzle picture of Fig. 8.2 illustrates embedding, but it also illustrates the importance of set because (a) finding hidden figures is a relatively unfamiliar task; (b) the dogs are close to many other patterns; (c) you don't see the dogs unless you look for them; (d) the hidden figures are in three dimensions.
19. In one of the problems at the beginning of this chapter the preparation is given by the instructions; hence one can proceed immediately to produce solutions. Which one?
20. In describing how a person solves a problem, which fact is irrelevant?
 - a. Specification of the solution.
 - b. Number of shifts of production.
 - c. The thinker's motivation.
 - d. Correctness of the solution.

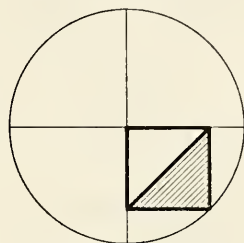


Fig. 8.11. If the base of the shaded triangle is one inch and its area is half that of the square, what is the area of the circle?

JUDGMENT

Some problems require, not a complicated solution, but the choice of one of a small number of communicative responses. Such a communicative response is called a judgment. In a court of law, for example, the problem for the jury is to communicate to the court that the defendant is guilty or innocent. An inspector may have the problem of judging each product prime, choice, good, or utility, and communicating these judgments to others by a stamp. The teacher judges his students' work A, B, C, D, or E and sends these judgments to students and registrar. A person may even make a judgment as a guide to himself at a later time, as when a writer judges his novel

complete or incomplete, or when anyone in the middle of solving a complicated problem decides which of three possible strategies to follow. In these cases the thinker shifts from producing ideas to judging what he has produced. These examples are all problems, as this term is defined at the beginning of this chapter, for if a rewarding response could be made at once, the activity would be called something else, perhaps perception or recognition.

As these terms are used by psychologists, decision and judgment are synonymous.

Here are a few judgments for practice.

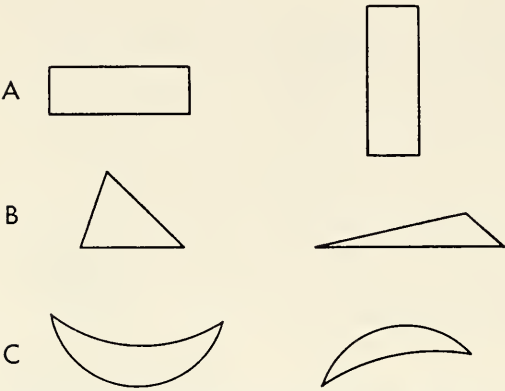


Fig. 8.12. Comparative judgments. Which of each pair is larger?

A VARIETY OF JUDGMENTS

1. Judge each pair of designs in Fig. 8.12 in respect to size. Put a check inside the larger of each pair.
2. Rate each of these foods as to pleasantness or unpleasantness to you. 3 means neutral. 2 means unpleasant. 1 means very unpleasant. 4 means pleasant. 5 means very pleasant. Underline the number that expresses your judgment.

creamed onions	1	2	3	4	5
grapefruit	1	2	3	4	5
lemon pie	1	2	3	4	5
fried liver	1	2	3	4	5
pork chops	1	2	3	4	5

3. Rate these men in respect to looks. Use a scale from 1 to 9 on which 5 is average, 7 is good-looking, 8 is handsome, 3 is homely, 2 is ugly, and so on.

	<i>Looks</i>	<i>Intelligence</i>
George Washington	_____	_____
John F. Kennedy	_____	_____
Lord Byron	_____	_____
Alfred Einstein	_____	_____
Abraham Lincoln	_____	_____
Mahatma Gandhi	_____	_____
Albert Schweitzer	_____	_____
Nikita Khrushchev	_____	_____

Now go back and rate each man in respect to intelligence. Use a scale from 1 to 9 in which 5 is average for the general population, 1 is very low, 9 is very high, and so on.

4. Rank the circles of Fig. 8.13 in respect to regularity, putting 1 inside the most regular, 2 inside the next most regular, and so on to 5 inside the most irregular.

Throughout life one is constantly judging his own work and the work of others, and others are judging his work. A thinker usually judges his solution to a problem before he is finished with it, and the solution is usually judged by his boss, his colleagues, and perhaps his wife and children. The writer evaluates his achievement before he lets it go, then he waits for the judgments of editors and reviewers. The artist uses his own standards of judgment first, then waits for the judgment of museum directors and art critics.

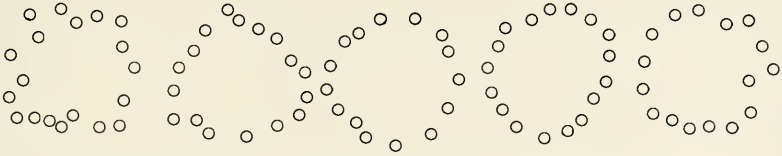


Fig. 8.13. Judgment by ranking. Rank in order of regularity from 1 to 5.

In the final analysis this is the criterion of creative accomplishment. We consider Thorndike, Pavlov, and Freud creative thinkers because others were impressed by their work, because editors accepted their research for publication, and finally because historians judged their work worthy of space in histories of psychology.

Here is the difference between applied science and pure science. The problem solving of the applied scientist is judged by his employer, who assigned him the problem in the first place and pays his salary. The output of the pure scientist is judged by his colleagues, editors of scientific journals, and textbook writers. Commercial art is judged by the customer who pays the fee, while fine art is judged by other artists, museum directors, and, eventually, art historians. Creative thinking is a lonely occupation, but evaluation of the product is a social process.

Preparation for Judgment. The set for judgment is more specific than the set for other problems. The court instructs the jurors what evidence they can consider and what is irrelevant, and also how their judgment must be officially expressed. In the psychology laboratory the experimenter tells his subjects what stimulus variables to observe and what responses to use. One can get set to judge some perceptual aspect of the object of judgment, as in Nos. 1 and 4 above, or its pleasantness, as in No. 2, or some abstract quality, such as intelligence or virtue. And one may, if unprepared, stumble into an expression of judgment without knowing what he was supposed to judge.

On the response side, the judge gets set to make a communicative response as instructed. He can compare two stimulus objects, as in No. 1, and say which is larger, or sweeter, or more charming. This is called a *comparative judgment*. Or the judge can rate each object on a scale of 5 points, as in No. 2, or of 9 points, as in No. 3. This kind of judgment is called *rating*.

Or, if the number of objects is not too large, the judge can rank them in order, as in No. 4, and this is known as *ranking*. In essence, the judge's job is to relate the response variables to the stimulus variables.

Stimulus Variables

What does the judge judge? If you ask him to compare two objects in respect to size, he will probably attend to size and ignore shape and color. The information on sensory functions presented in Chapter 4 was obtained mostly by this procedure, by asking the subject to judge such variables as brightness, loudness, sweetness, and length. But if the object of judgment is complex, the judgments will be influenced by more than one stimulus variable and it then becomes a research problem to discover just what he was judging.

Here is the way the research is done. Suppose you ask a child to rank the rectangles of Fig. 8.14 in order of height, and he ranks them A, B, C, D.

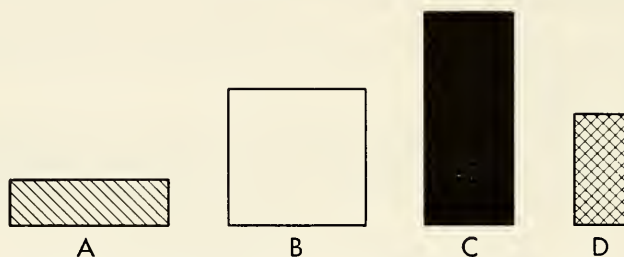


Fig. 8.14. A child was asked to arrange these in order of height and this is what happened. Explain.

Since the correct rank order for height would be C, B, D, A, obviously he is not judging height. What is he judging? Blackness would be C, D, A, B. Another possibility is width, and we see that the rank order for width agrees with the order in which he ranked them. Therefore it is a fair guess that he judged width rather than height, and we could check this guess by having him rank another set of four rectangles. In one experiment of this kind on judgments of girls' personalities the results showed that the girls who were rated high on intelligence were the ones who had been wearing glasses.³⁸

The question of what the judge is judging is not just a theoretical question but one of considerable practical importance. When carbonated beverages are prepared according to several recipes and offered to people for choice, it turns out that the amount of sugar is one of the most important variables affecting judgments of desirability. To improve grading standards housewives have been asked to rank five eggs that differ in size, color, cleanliness, uniformity, etc., and the results show the importance of each of these fac-

tors in the decision to buy. The important principle is that if we want to know what influences a person's judgments, it is not enough to ask him. It is better to compare his judgments with the stimulus variables.

Social Interaction. Many experiments in the psychology laboratory have proved that a person's judgment can be slanted by social influences. If we ask a small boy what he thinks of several automobiles, we may find out that his opinions are the same as his father's. He does not really judge the automobiles; he accepts his hero's judgments as his own without going through any critical judgment process. In general, anyone is likely to accept another's judgment in place of his own when he admires the other person or considers him an expert. This effect is called *prestige suggestion*.

Analysis of our boy's judgments may show, however, that they agree, not with the judgments of any one person of prestige, but with the judgments of his gang. Adults also often decide only after hearing the opinions of the group to which they belong. This is, of course, the *conformity* principle, and both the conformity principle and the prestige principle will be used in reverse in later chapters. That is, by noting how a person's judgments are influenced, we can tell whom he considers a prestige person and to what groups he conforms.

General Impression. When someone is asked to rate several people in respect to several traits, such as intelligence, leadership, sociability, and industriousness, he will usually rate some high on everything and some low on everything. It seems reasonable that a person could be high on intelligence and low on industriousness, but it is difficult to analyze these qualities and rate them separately. Judgment by general impression may also show up when teachers grade students' papers, especially if the teacher grades one student on the answers to all questions, then another student on all answers, and so on. This source of error is likely to be reduced when the teacher grades all students on one answer, then all of them on the next answer, and so on.

Effects of Difficulty. Judgment of some stimulus variables is harder than judgment of others. As a rule, abstract qualities are hard to judge, while it is easy to judge how much you like something. Thus it happens that when one is asked to judge a man in respect to something abstract, such as leadership, one may simply judge whether one likes him or not. In place of communicating a difficult abstract judgment one reports an attitude. If you are asked to evaluate Senator Jones' contribution to international relations, that is a difficult request, and you may take the easy course and report what you hope will happen.

The best way to overcome the distorting effect of likes and dislikes is to make the requested judgment easier. One who reads about international relations and knows the significance of Senator Jones' activities is less likely

to be influenced by personal feelings. Well-informed people have some basis for making the difficult judgments and are therefore less influenced by personal feelings, and by prestige and conformity, than uninformed people.

Response Variables

The response which communicates a judgment may be made in many ways. In a baseball game the umpire raises his right hand to indicate that he has called the pitch a strike, his left hand to indicate that it is a ball. In large organizations foremen and supervisors are often asked to communicate their judgments of employees by making marks on rating scales and forms prepared by the personnel psychologist. In any case the number and kind of responses permitted is limited by custom or request, so the judge gets set to compress his communication into one of these response categories.

Relativity of Judgments. When the police came into Mr. Stone's jewelry store and asked about the suspicious man who had been hanging around the day before the robbery, Mr. Stone described him as tall. Just what does this judgment communicate? The answer depends, of course, on the system of responses that Mr. Stone was prepared to use. If he was thinking in terms of only two categories, "short" and "tall," as in Fig. 8.15, "tall" would be

Response categories	Short							Tall						
Stimulus variable in inches	63	64	65	66	67	68	69	70	71	72	73	74		

Fig. 8.15. A scale of two categories of judgment.

used for all men of 69 inches or more. If he was thinking in terms of three categories, as in Fig. 8.16, he would use the category "tall" for men of 71 inches or more. But he might be accustomed to a scale of four categories,

Response categories	Short							Medium				Tall		
Stimulus variable in inches	63	64	65	66	67	68	69	70	71	72	73	74		

Fig. 8.16. A scale of three categories of judgment.

as in Fig. 8.17; hence "tall" would mean only men of 69, 70, and 71 inches, those above 71 being called "very tall." Likewise a grade of C has a different meaning on a scale of A, B, C than it has on a scale of A, B, C, D, E. Many judgments are made in terms of scales like these, in casual conversation, in letters of recommendation, and in discussions of controversial issues, so it is

worth while to see how such scales are developed and tied to the stimulus variables.

Development of Scales of Judgment. These responses are learned, of course, not by simple association of a specific response with a specific stimulus, but by a kind of generalization or concept formation. When Mr. Stone was young,

Response categories	Very short			Short			Tall			Very tall		
Stimulus variable in inches	63	64	65	66	67	68	69	70	71	72	73	74

Fig. 8.17. A scale of four categories of judgment.

he learned the meaning of such concepts as “short,” “medium,” and “tall,” in connection with flowers and trees as well as men, but when he is judging men, he remembers the range of men’s heights and lines the response scale up with the remembered stimulus variable. He may not have thought about this scale seriously, and probably never drew graphs like Fig. 8.17, but he has had plenty of practice in social situations and uses scales of two, three, and four categories without difficulty. After he has learned these concepts, he uses them as categories into which people can be classified according to the way they are strung together in a scale of judgment. Simple response categories like “short” and “very long” and familiar stimulus variables like height are learned in a common environment, and when different people use scales made up of the same familiar categories, their judgments agree fairly well. In a language of Chapter 5 we can say that the different judges agree because they are using the same frame of reference.

We can see more clearly how scales are developed if we examine those scales that are used temporarily in special situations. When a teacher grades papers and judges them A, B, C, D, his scale is influenced not only by the papers he has read in the past but also by the range of achievement in the papers he is reading now. Thus a paper that rates a C when judged with one group of papers might rate a B in another group. This anchoring of the scale of judgment to the present range of stimulus objects is a very common phenomenon that shows up in many places. Psychologists working with the Air Force have found that a cadet pilot making his test flight at the end of primary pilot training is more likely to be rated “pass” by the flying instructor if he is judged with a group of cadets of relatively low aptitude than if he is judged with a group of high aptitude.³⁴ Likewise, when children are asked to take “a few” beads from a tray, or “some of” them, or “a lot of” them, the number they take depends not only on previous learning of these concepts but also on the frame of reference furnished by the beads in the tray at the moment.³⁵ For example, children of 12 and 13, when asked to take

"a lot of" beads, took 14, on the average, from a tray holding 25 beads, but when the tray held 50 beads, "a lot of" them meant 26. When the tray had 200 beads, the average number judged to be "a lot of" them was 51 (see Fig. 8.18).

The scale on which anything is judged may shift, of course. If a teacher

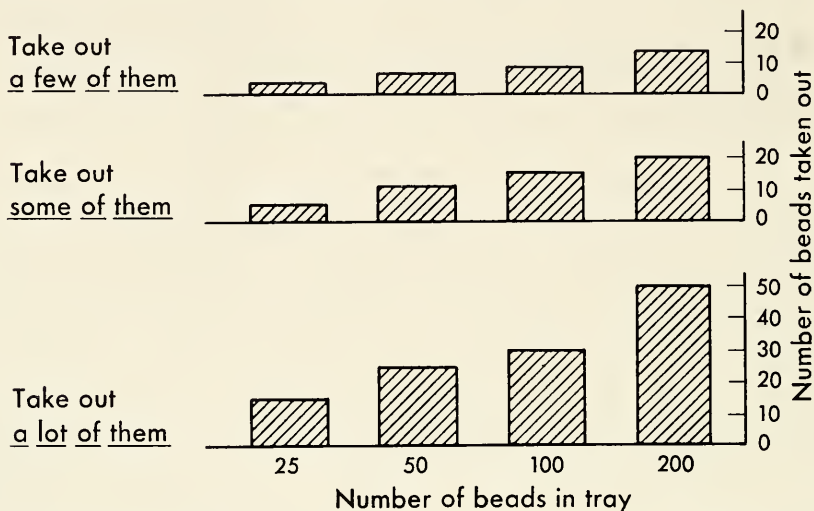


Fig. 8.18. When children are asked to take beads out of a tray, the meaning of concepts such as "some of them" depends in part on the frame of reference furnished by the number of beads present. (Data from Cohen, Dearnley, & Hansel³⁵)

moves from a school with superior students to one with average students, he may give everyone C's and D's the first term, but sooner or later he will adjust his scale to the present range of achievement. If someone is used to spending a dollar for lunch, he will probably call a dollar lunch "medium" and a two-dollar lunch "expensive," but after a few years of inflation, his scale will have moved upward so that a two-dollar lunch will fall in the "medium" category. Such shifts in the scale of judgment have been produced experimentally in the laboratory also; a 1000-cycle tone sounds "high" when the other tones are lower, but if high-frequency tones are presented, the whole scale moves up and a 1000-cycle tone is called "low." Laboratory experiments of this kind have also demonstrated the effectiveness of the "big lie" technique in changing attitudes. College students were asked to judge such statements as "War is the only means of preserving our national honor," and most judged them in the "disagree strongly" category. When they heard others judging such statements "neutral," a few tended to conform to the group, but when they heard others judging such statements in the "strongly agree" category, about half of them swallowed the "big lie" and judged these statements more favorably.³⁶ The same technique of going to

the extremes is used by the dress designers. When they want women to buy dresses with lower hemlines, they photograph models with hemlines six inches lower, hoping that most women will shift in that direction and accept a change of two inches.

Training in Judging

The best training for judgment, as for many other activities, consists of practice followed by correction of errors. Most people can judge weights on a standard scale of pounds with some accuracy because they have often lifted objects and guessed their weights before weighing them. In judging distances in yards in an open field one group of young men and women of normal vision made errors averaging 33 percent at first, but after correction their average error in judging distances from a different location was only 14 percent. The improvement in these cases is not due to the association of a particular response, e.g., 136 yards, with any particular stimulus pattern, for that kind of learning will not transfer to different situations. The improvement consists rather of a generalized adjustment of one's scale of yards to the perceived plane.³⁷ Likewise when a panel of housewives tasted samples of beef and rated each as to freshness, their accuracy (compared with the known percentage of rancid beef in each sample) improved from the first week to the third.³⁸

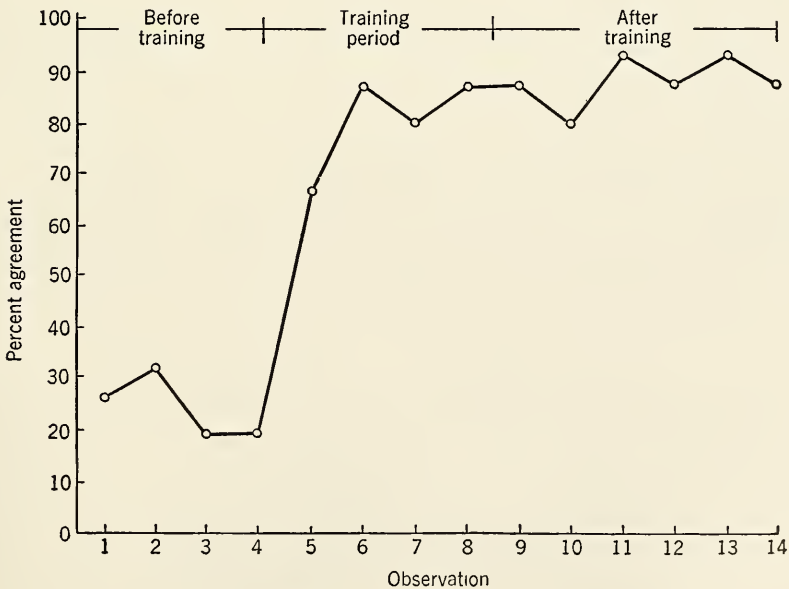


Fig. 8.19. Accuracy of judgment and training. Showing the agreement between two observers rating nursery school children on several classes of social behavior. (From King, Ehrmann, & Johnson³⁹)

When the judgments are complex, like judgments of personality traits, there are no objective measurements by which they can be corrected. The training in these cases consists of comparing one person's judgments with another's and improving the agreement between them. Two judges observe a few people and make a few judgments, e.g., of their sociability. Then they get together and compare their judgments, trying to define sociability and the other stimulus variables precisely, and to eliminate halo effect, irrelevant variables, and other errors. They also try to define the response scale more accurately, agreeing on what is average sociability, extreme sociability, and so on. They then make some more judgments independently, and note agreements and disagreements on these. When this procedure is followed, the increase in agreement may be large,³⁹ as in Fig. 8.19.

OVERCOMING DIFFICULTIES

By way of summary: The major difficulties in solving problems revolve around unfamiliarity and abstractness of the material, amount of information to be integrated, misleading sequences of problems, and embedding of significant relations. The serious thinker gets around these difficulties by a variety of devices which are not solutions in themselves but which serve as aids, intermediaries, or instruments toward a solution.

Arranging the Information. When there is too much information to retain, the usual procedure for reducing the difficulty is to write down the information. Taking the strain off the memory in this way permits closer attention to relations within the data. Better yet, of course, is to write the information in some systematic arrangement, so that gaps and important relations can be more easily observed. The simplest arrangement of information is that recommended by Poor Richard when he advised listing the advantages of a course of action on one side of the page and the disadvantages on the other side, as in Fig. 8.20. Having them all in view one can weigh the advantages

ADVANTAGES	DISADVANTAGES
Save time in travel	Down payment
Carry friends	Upkeep
Good buy now available	Parking nuisance
May help get job	May not be able to make payment

Fig. 8.20. Two-column arrangement of information to facilitate a decision about buying a car.

and disadvantages and reach a decision. Many people make decisions about money matters with the aid of a simple bookkeeping system that lists income on one side of the page and outgo on the other side. Elaborate accounting systems have the same function, integrating large amounts of data so that someone can more easily use them to solve a problem.

To apply this trick to the concept-formation problem, consider this one: b is a glub, but e is not; h is a glub, but o is not; t is also, but n isn't; and so is f, but not v. Which of these are glubs: a, c, d, k, l, m, r, s? And what is a glub anyway? If the positive and negative instances are systematically arranged, it is somewhat easier to discover similarities and differences, thus: b, h, t, f and e, o, n, v.

Life often forces us to make plans and decisions even though our information is uncertain. The decision to buy or not to buy a car might be based on the probability of getting a job and thus needing transportation and also on the probability of not getting a job and thus being unable to pay for the car. With two events, getting a job and not getting a job, and two decision alternatives, buying and not buying, we can anticipate four possible outcomes, as shown in Fig. 8.21. Two of these outcomes are good and one is

Decision Alternatives	Probable Outcomes	
	Get job; prob. = .6	No job; prob. = .4
Buy	Pay starts; convenient transportation 10	Lose car and down payment -12
Don't Buy	Pay starts; transportation difficult 5	No special gains or losses 0

Fig. 8.21. Two-by-two arrangement of decision alternatives and probable outcomes to facilitate estimation of the effects of each decision.

bad, so we can go farther and assign positive and negative values to each. If buying a car is followed by getting a job—upper left cell—this is a very desirable outcome which could be given a utility value of 10. If buying is followed by not getting a job—upper right cell—this outcome has a serious negative utility, perhaps -12. On the same scale we may estimate the outcome in the lower left cell as about 5 and the lower right cell 0. Now if we guess the chances of getting a job as better than even, say .6 to .4, we can use all this information to aid the decision. The decision to buy has a prob-

ability of .6 of producing an outcome worth 10, or $.6(10)$, and a probability of .4 of producing an outcome worth -12 , or $.4(-12)$. Since both outcomes must be considered, the utility one may expect in general from such a decision is $.6(10) + .4(-12)$, which is 1.2. Likewise the best guess of the worth of the other decision is $.6(5) + .4(0)$, which is 3. Hence the decision not to buy is more likely to have generally advantageous outcomes. Such schemes for arranging the evidence do not solve any problems by themselves, but they pull the information and its implications together and make it easier for the thinker to see the whole picture and thus to solve the problem to the best of his ability.

Transforming the Information. When the facts are unfamiliar, or too numerous, or the relations between them are too abstract, many people change the information into some other form. Numerical relations may be easier for some people to handle when they are put in verbal form. The verbal statements of Fig. 8.21 may be coded in mathematical form, as when one says that there is a 20 percent chance he will not get the job. Whenever the available information can be transformed into mathematical language, one can take advantage of the great potentialities of mathematical manipulations.

Problems that seem quite abstract when stated in verbal or mathematical terms may seem less abstract when recorded in graphic form. Consider this simple problem: Mary is taller than John, and John is taller than George, but Jane is shorter than John. Which girl is taller? It is possible to transform these verbal relations into graphic form in a straight-line pattern, as in Fig.

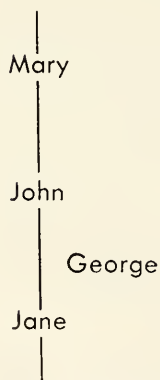


Fig. 8.22. One way of putting abstract relationships into a visual pattern.

8.22, and read off the relation between Mary and Jane. The irrelevance of George also shows up in this arrangement. Some people report that they see an image like Fig. 8.22 and have no need to draw it. Others seem to get the same help from gestures with their hands.

Often the facts of a problem can be reworked so as to fit into the form of the syllogism or some other model that the logicians have standardized. If all borogoves are mimsy, and David L. Stone is a borogove, what can we say about Mr. Stone? There are a variety of standard forms for such statements, usually studied in a course in formal logic, and it is even possible to recode them into graphic form, as in Fig. 8.23, and thus make these abstract relations more concrete. Manipulating relations between facts in this way so as to reach a logical solution is what we usually mean by *reasoning*, and it is

helpful to have a supply of standard forms, models, or types of solution on hand, whether verbal, graphic, or mathematical, when one encounters a new problem.

Several great creative thinkers have recommended an alternation technique for overcoming difficulties like functional fixedness and rigidity. They load up with the facts and make an initial attack on the problem, then, when progress seems slow, they abandon it for a while and come back to it later. This takes advantage of the possibility of incubation and of breaking up fixed patterns. Most of the easy problems have been solved, so when a genuine creative accomplishment appears, the thinker has usually been working on it for some time. Even when not working on it actively, he may be thinking, or at least daydreaming, about alternative ways of approaching the problem.

Language and Thought. Our review of concepts and other verbal achievements in the preceding chapter emphasized the usefulness of language in thinking, so one might ask if anyone deprived of language could still solve problems. He certainly could; and he would use the concepts he had learned up to that time, just as one who loses his vision at age 12 would continue to think of the world in visual dimensions. But how about children who have not yet learned a language? The preceding chapter noted that the ability to name a concept and the functional use of a concept are not exactly the same, and one might expect that some children would learn one first and some would learn the other first. Around age four, for example, some children can tell what "middle" means and some cannot, but those who cannot are able to solve problems in which the correct solution is to pick the middle block, and they transfer this solution to other problems in about the same way as those who can talk about it.⁴⁰ Since we know that language is acquired by listening as well as talking, we can also make some instructive comparisons by studying children who have been deaf since birth or since early childhood and thus have not had the advantages of verbal intercourse with others.

Young deaf children, age four to seven, do quite well, in comparison with children of normal hearing, on perceptual problems, even on those that involve subtle perceptual relationships, as in guessing whether the faster or slower truck is associated with a reward, and reversing this relationship, and in opening boxes according to certain rules. Where they are handicapped is on problems in which the perceived situation is simple, e.g., two doors, and the difficulty of the problem is the complicated way in which the reward is switched from one door to the other. The normal child of five solves these double-alternation problems with the aid of language skills picked up in the ordinary give-and-take of social interaction, such as the concept of two. Deaf children cannot do these problems until age seven or so, when they



Fig. 8.23. Another visual pattern of logical relationships.

have mastered simple number concepts by special kinds of teaching.⁴¹ Older deaf children show a marked inferiority on intelligence tests and particularly on problems of logical reasoning, presumably because it is hard for them to acquire the concepts and forms of reasoning that normal children pick up by daily incidental learning.⁴²

INDIVIDUAL DIFFERENCES

Although the concepts and principles presented in this chapter apply to all individuals, one individual may differ considerably from another in the thoughts he thinks, the methods by which he approaches problems, and his percentage of successes. Success in solving one or two problems cannot be taken as a fair measure of anyone's problem-solving ability because he may accidentally start on a fortunate approach while someone else may start on a misleading approach. It is not uncommon that one acquires a temporary reputation as a genius by a lucky break in solving a few problems; and a bad break can do the reverse. The percentage of success on a number of standard problems is a more dependable score for comparisons between people.

Previous Learning. When stable scores are available, it always turns out that individual differences in problem-solving success are related to differences in what these individuals bring to the problems, that is, in the achievements of past learning or education. Those who get high scores for solving arithmetic problems also get high scores as a rule when tested on previously learned arithmetic skills, such as addition and long division. Those who do well on verbal assignments, such as an original essay or a humorous poem, have in the past acquired large vocabularies and a knowledge of sentence structure and usage. And those who solve a variety of economic problems successfully have more knowledge of economic principles, common mistakes, and methods of judging economic risks than those who fail often.

General Ability. Past learning does not account for all the variance between individuals in solving problems, however. People differ in respect to abilities and we can say as a rule that those who get high scores on a test of general ability or intelligence do better in solving the general run of human problems than those who get low scores on intelligence. Chapter 11 will consider abilities such as intelligence and the procedures by which these abilities are tested, but individual differences in solving problems are related also to differences in the problem-solving activities described in this chapter.

Problem-Solving Abilities. Individual differences in the production of words are tested simply by asking people to write words as fast as possible: words that begin with *p*, words that rhyme with "tune," and the like. Naturally

those who get high scores on an ordinary vocabulary test, measuring words learned in the past, get high scores on tests of word production. But vocabulary is only one factor; the other factor is fluency in turning out the words that one has learned. Hence these are called tests of *fluency*. Tests of *ideational fluency* ("Write words that can be used to describe a house." "Write uses for a brick.") are more closely related to success on practical verbal assignments, such as theme writing, than tests of simple word fluency.

Success in solving some problems requires not only fluency of production but *originality* of production, especially if the problems are of the kind called creative, and it is possible to compare individuals in the originality of the ideas produced. We have seen that word problems are difficult if the words required are uncommon ones, and we can compare individuals in respect to the uncommonness of the words they produce. For example, if the word "white" is given, most people will say "black," but an original person might say "angel" and another might say "albino." Or we can show someone three simple drawings and ask in which way they are all alike. Most people will give common similarities, but the original individuals will give unusual ones. Another test gives the subjects the plot of a story and asks them to make up appropriate titles for it; the titles are then rated as to cleverness by expert judges. And another test of originality asks for a list of consequences of an unexpected event such as the sudden abolition of all national and local laws. A low rating is given to an immediate consequence, such as "no more parking tickets," and a higher rating to a remote consequence, such as "no more taxes." An individual who produces original responses on one of these tests of creative thinking is likely to produce original responses on the others also, and the total score is a measure of general originality.⁴³

Flexibility in shifting from one way of solving problems to another would appear to be an important problem-solving ability, and in each of the experiments on shifting activities described in this chapter some individuals shift better than others. But a person who shifts flexibly on one problem may be rigid on another, so the scores obtained are not very stable measures of anything. We may someday, after a scientific breakthrough, have a new method that will yield more stable scores for a person's general flexibility in solving problems.

We have seen that problems are difficult when the material of the problem is abstract. Consequently, one characteristic that differentiates a good problem solver from a poor one revolves around the manipulation of abstract patterns, such as concepts, principles, and structures of logical relations. Solving problems by manipulating such relationships has been called reasoning, and the ability to do this is called *reasoning ability*. The essence of

this ability, as it is manifested on different kinds of problems, seems to be the capacity to organize the facts and relationships of a problem into a comprehensible structure in preparation for producing solutions.⁴⁴

Individuals differ from one another in ability to break up and reorganize patterns, and those who are susceptible to functional fixedness on the two-string problem of Fig. 8.9 are snagged by the embeddedness of such perceptual patterns as Fig. 5.8.³¹ It may be possible someday to assemble a variety of problems into a dependable general test that will describe people in this respect. The technical procedures for constructing such tests will be described in Chapter 11.

People differ one from another in ability to make good judgments, but in respect to judgments of simple stimulus variables these differences are quite specific. That is, one who judges sounds accurately may or may not judge lights accurately. But the ability to make good judgments about complex matters, as in administering the affairs of a large organization, involves manipulating abstractions, and those who rate high on general reasoning ability do best on such judgments. Making judgments about people involves reasoning ability and also certain interpersonal factors that will be discussed in Chapter 12.

Personal Variables. Since motivation is needed for problem solving, as for everything else, people who get high scores on a test of achievement motivation, like those described in Chapter 3, work longer on difficult problems and get more right than people who get low scores on achievement motivation.⁴⁵ When we compare men and women on motivational variables, an interesting sex difference appears. College men are superior, on the average, to college women of the same general intelligence and educational background when they struggle with difficult problems, such as No. 11, about the ski poles.³ The most likely reason for this difference is that men emphasize achievement along this line while women do their best problem solving along other lines. In fact those individuals who get high scores on a test of masculinity of interests, whether they are men or women, actually do better on difficult problems than individuals of the same general intelligence who get low scores on masculinity.⁴⁶ College men have more favorable attitudes toward problem solving than college women, we know, but after women have discussed their own attitudes and the relation between attitudes and success, some women become more highly motivated and actually solve more problems on the next test.⁴⁷

Differences due to age work in both directions. An older person has more information with which to solve problems, more knowledge of the common errors, and more experience in solving many kinds of problems than he had when he was younger. He has probably already solved many of the problems that younger people are at present facing and may be able to

recall a satisfactory solution. It is when the problem requires reorganization of the material or flexibility in shifting set that comparisons between age groups disclose the handicap of the aged.⁴⁸

Style of Thought. Regardless of success in thinking, there are interesting differences between people in the way they go about it, that is, in style of thinking. Some prefer risky strategies while others adopt the more conservative approach. Some attack the problem as a whole while others prefer to break it up and work on one part at a time. Some put their faith in general principles while others want to accumulate facts. Some spend considerable time on preparation while others start immediately to produce solutions. In making judgments on a scale some use the extreme categories frequently while others make most of their judgments in the middle. And some people characteristically express their judgments on most subjects with high confidence, but these are all expressions of personality or style of life and have little to do with any measures of success.

Special peculiarities of this kind that often show up on printed personality tests and questionnaires like those illustrated in Chapter 13 are called *response sets*. Some people tend to judge most statements true and others prefer to use the "false" response. Some tend to agree with strongly worded statements, whatever they say, while others tend to disagree with such statements. Most response sets are specific to the nature of the material but within these limits they help to describe individuals in respect to their characteristic style of thought.

SUMMARY

Some evidence on thinking comes from reports of consciousness and from physiological data, but most of it comes from observation of a person's behavior as he attempts to solve a problem. A person has a problem when he is motivated toward a goal but finds his first response not rewarding. In general, when anyone tries to solve a problem, we say he is thinking, but not after he has solved it and is trying to acquire more skill, and not when he is responding reflexly or emotionally.

Preparation for problem solving consists of such activities as orienting to the problem, surveying the problem situation, and specifying the solution in a preliminary way. Naturally, the more adequately the solution is specified, the easier the problem is; we call it creative thinking when the solution cannot be specified in advance.

When anyone starts to produce ideas to solve a simple problem, he selects relevant ideas from his memory or from the present situation with more or less fluency. Typically he produces ideas rapidly at first, then slows down. The ideas that come first are, in general, the more common ones. Frequently

interferences of one kind or another develop, but if he puts the problem away temporarily, these may drop out and some new ideas may be incubated. If the solution does not come readily, one usually shifts problem-solving activities, with more or less flexibility, or rigidity. Emotional excitement and some kinds of practice reduce flexibility. High-level practice increases flexibility.

Frequently, when the problem is a complex one, solution involves manipulating relationships of the parts and wholes and constructing new patterns. Manipulation is difficult when the parts are unfamiliar and when there are too many to remember. By recording problem-solving attempts it is possible to identify a variety of strategies for handling all this material. Different strategies have different advantages and disadvantages for problems of different characteristics. Another difficulty is the embedding of a crucial part of the solution in some other pattern, so that the thinker fails to use an object to solve a problem because he has previously used that object in another context. The kinds of practice that resemble problem solving provide the thinker with principles and skills that can be applied most readily to new problems.

A judgment is a problem the solution to which is one of a small number of communicative responses. In simple situations, as in guessing people's heights, one attends to a specified stimulus variable. When the objects of judgment are more complex, special investigation is needed to identify the variables that determine the judgments. Prestige suggestion and conformity enter in, and many judgments are made on the basis of a general impression. Judgment of abstract variables is difficult, so people often deliver a personal opinion or attitude in its place.

On the response side, all judgments are relative to a scale or set of response categories, the communicative significance of which is learned in social interaction and may shift from time to time. Hence communication is precise only when these scales are standard. Training in judgment consists of corrected practice in identifying the specified stimulus variables and in standardizing the response scale.

The serious thinker tries to overcome these difficulties in the solution of problems, including problems of judgment, by arranging the available information more systematically, and by transforming or recoding the information into manageable patterns, often making use of standard symbols and logical forms. Hence thought has a special kind of relation to language.

When individuals are compared in respect to the solutions they achieve, the differences can be related to individual differences in previous learning, general intellectual ability, and special problem-solving abilities, such as ideational fluency, originality, flexibility, and reasoning ability. There are differences also between age groups and sex groups, because of differences

in interests, persistence, and conformity, as well as abilities. There are individual differences also in style of thought, in characteristic ways of attacking problems, and in preferences for judgment categories, which are important for the description of personality but have little to do with measures of problem-solving success.

PRACTICE PROBLEMS

21. When people speak, in nontechnical language, of "mental activity," are they referring to (a) consciousness, (b) decisions, (c) set, (d) physiological processes, or (e) responses?
22. Suppose you ask a friend to judge the past seven presidents as S for statesman and P for politician, and he labels them as follows: Kennedy S, Eisenhower P, Truman S, Roosevelt S, Hoover P, Coolidge P, Harding P. What stimulus variable determines his judgment?
23. Suppose you ask a friend to rate these novelists on a five-point scale with 5 being high and he gives you this record. What can you conclude about his basis of judgment?

Buck	4	Lewis	3
Cather	5	Marquand	2
Faulkner	3	Mitchell	4
Glasgow	4	Wharton	5
Hemingway	4	Wouk	2

24. A college class rated poems A, B, C, and D on a five-point scale, with 5 high, as follows: Poem A (attributed to Sandburg) was rated 4.2 on the average; Poem B (attributed to Smith) was rated 2.8 on the average; Poem C (Frost) 4.3; Poem D (Green) 2.9. Then the names on the poems were switched and they were given to another college class with these results: Poem A (attributed to Smith) 3.0; Poem B (Sandburg) 4.0; Poem C (Green) 2.9; Poem D (Frost) 4.2. How can you account for these peculiar results?
25. When the photos in Fig. 8.24 were shown to a group of men for personality ratings, B, C, and E were judged high on honesty. Why?
26. Wherein lies the chief difficulty of Problem 4 at the beginning of this chapter: preparation, production, or judgment?
27. On a test of originality the question is asked: "What would happen if all college teaching were conducted by television?" Which of the consequences below should get the highest rating for remoteness?
 - a. Classrooms would be empty.
 - b. Big demand for educational films.
 - c. Big sale of television sets.
 - d. Teachers would learn new skills.
28. The task is to think of different uses of a brick in two minutes. Mrs. A writes: Build a house, make a walk, make a bookcase, make a wall. Mrs. B writes: Make a sidewalk, build a house, throw at a cat, block the wheels of a car, a pendulum bob. Which woman is more fluent, and why?
29. Which woman is more flexible, and why?



Fig. 8.24. Judgment problem. When these photographs were judged for personality, B, C, and E were rated high on honesty. Why?

30. What is the essential merit of decision models such as the one illustrated by Fig. 8.21?
- a. Uncertainties are reduced.
 - b. Information is integrated.
 - c. The model suggests a useful strategy.
 - d. Calculations are minimized.
31. Under what conditions would you expect someone to use a scale for judging men's heights like that shown in Fig. 8.25?

Response categories	Stimulus variable									
	Short			Medium				Tall		
in inches	70	71	72	73	74	75	76	77	78	

Fig. 8.25. A temporary scale of three categories.

- a. Working in a shoe store.
 - b. Working in a men's clothing store.
 - c. Watching a basketball game.
 - d. Watching the high jump at a track meet.
32. When Mr. Stone went to the bank to borrow money to enlarge his jewelry store, the banker reached in the drawer of his desk and pulled out a four-page light-green printed form. Then he asked Mr. Stone many questions and from the answers he filled in the blanks on this form. Which two of the following explain the functions of this form for the banker?
- a. It helps him form a new concept.
 - b. It arranges the information in a standard pattern.
 - c. It allows him to check on the validity of the information.
 - d. It reminds him of the information he needs.
 - e. It saves him the trouble of making a difficult decision.
 - f. It clarifies the description of Mr. Stone's strategy.
 - g. It helps him organize a scale of judgment.
33. Is a strategy a construct or an observable?
34. Is flexibility a construct or an observable?
35. Psychology attempts to describe how judgments are made. What disciplines attempt to assert how judgments should be made?
36. The principal difference between learning and thinking is (a) the difficulty of the task; (b) the contribution of practice; (c) the time required; (d) the abstractness of the material.
37. Problem solving could be considered a kind of learning if (a) learning is synonymous with conditioning; (b) the problem involves concepts; (c) recall is required; (d) learning is defined broadly.
38. What do we need to know before we can say that the difficulty of a problem is due to embedding?
- a. Relation between desired solution and other material.
 - b. Amount of information to be manipulated.
 - c. Logical implications of the information.
 - d. The pattern of the solution.
39. Arrange these terms in order of increasing abstractness: culture, house goods, possessions, silverware, spoon.
40. Arrange these terms in order of increasing abstractness: concepts, facts, theories.
41. A person is said to have a response set if he makes one of these responses more often than other people do. Which one?
- a. Agrees with statements derogatory to Catholics.
 - b. Raises his voice when talking about taxes.
 - c. Agrees with statements that begin: "In general, it is probably safe to assume that. . . ."
 - d. Disagrees with people who disagree with him.
42. Which of these abilities is most involved in writing poetry? (a) Reasoning ability; (b) fluency; (c) ideational fluency; (d) general ability.
43. When Fig. 8.18 is read horizontally, it gives information about the influence of the frame of reference. What information is obtained by reading the graph vertically?
44. The results shown in Fig. 8.18 come from an experiment done with school chil-

dren in England. What results would be expected if the experiment were repeated with adults in New Zealand?

- a. About the same.
- b. The number of beads in the tray would have no effect.
- c. The terms used would have no effect.
- d. The results cannot be predicted in advance.

In experiments on thinking, which of these would be independent variables (mark them Ind) and which would be dependent variables (mark them Dep)?

- | | |
|---|--------------------------|
| 45. _____ Solution time | 49. _____ Preutilization |
| 46. _____ Amount of material | 50. _____ Errors |
| 47. _____ Shifts of activity | 51. _____ Judgment |
| 48. _____ Order of presentation of problems | |

Discussion Questions

- A. Modern high-speed computers have sometimes been called "thinking machines." What can they do that man cannot do? What can man do that the machines cannot do?
- B. What are the principal differences between logic and the psychology of thought?
- C. Does success in college depend more on learning or thinking?

Recommended Reading

- R. Thomson. *The psychology of thinking*. Penguin, 1959. An up-to-date paperback discussion of problem solving, concept formation, creative thinking, and similar topics.
- B. Ghiselin. *The creative process*. Mentor, 1952. A paperback reprint of articles by Einstein, Jung, Henry James, Housman, Poincaré, Henry Miller, and other artists and scientists, describing their methods of work, their inspirations, and their beliefs about creative thinking.
- H. H. Anderson. *Creative thinking*. Harper, 1959. A collection of articles by 14 distinguished writers in diverse fields of art and science.
- D. M. Johnson. *The psychology of thought and judgment*. Harper, 1955. A systematic review of research.
- K. Duncker. On problem-solving. *Psychol. Monogr.*, 1945. No. 270. A report of ingenious experiments, including some of the first on functional fixedness, and theoretical explanations of the results.



Information Services, Michigan State University

Chapter 9. THE INDIVIDUAL IN ACTION AND REACTION

In this chapter we examine the individual in action in a busy world. His activities are the results of many factors—dynamic factors like those described in the chapters on motivation, and cognitive factors like those described in the chapters on perception, learning, and thinking. In some cases the action seems to be the sum or product of several different factors, a dependent variable depending on several independent variables. In other cases the mechanism is more complicated. Once the individual acts, his subsequent acts depend on the consequences of his initial acts. The action may generate its own resistance and grind to a halt. Or the action may generate a reaction, so the individual does the opposite of what he started to do. Man is a machine, it is true, but he is a special kind of machine that can observe his own acts and their effects on others and react by a new pattern of action. We shall consider first the simple case of action resulting from integration of motives, then activities that are considered work, and then a variety of mechanisms of reaction.

INTEGRATION OF MOTIVES

The reaction-time experiment illustrates in a simple way how motives may be combined. If you ask a friend to come over to the laboratory to be a subject for a little experiment, he will probably consent. What is his motivation? Partly social approval: one is supposed to cooperate unless he has good reason to refuse. Partly curiosity: he may be interested in seeing a new gadget and having a new experience. Partly achievement: many people want to test themselves on a speed task. For these motives, and probably others, he goes to the laboratory and listens to the instructions. He is told to hold the key down and let it go quickly when the buzzer sounds. He adopts the proper set and, after a little practice, his reaction time may be about 0.14

seconds on the average. Now let us add another motive. We will introduce an electric shock in the key when the buzzer sounds. The pain adds another motive, so he pulls his hand away quicker, and the average reaction time may drop to about 0.12 seconds.¹

A movie theater provides another situation in which the dynamics are integrated in one direction. The house is darkened except for a vivid stimulus pattern at one end. The seats, which are neither comfortable enough to encourage sleep nor uncomfortable enough to be distracting, all face toward the screen, furnishing a kind of social facilitation of attention. The lights on the screen are bright, the pattern is changing, and the noise is loud. The plot is usually a simple one that appeals to the interests and values of most people. The action is highlighted so that anyone can follow the story with very little visual or intellectual effort. People go to the movies with the expectation of relaxation from discordant dynamics of the day's work and in this respect they are usually not disappointed.

Most patterns of activity go along smoothly when the individual's motives are integrated toward a goal, and when discomforts and fears combine to steer him away from an unpleasant situation. As a rule, the individual operates as a unit, an organism. But when he is simultaneously preparing a course of action toward and away from some object, his activity is not completely unified, and inefficiency and mistakes are common. Suppose you go into a drugstore to get a cold drink of ginger ale. You take a sip eagerly, but it is lukewarm. You could decide to drink it anyway. Or you could decide to leave and walk out the door. If you cannot decide which to do, you do not integrate an efficient pattern of action. You may reach for the glass, grasp it insecurely, and spill half of it on your new suit. Some accidents occur because the individual was in conflict about what to do and thus could not do anything well. In this modern civilization of social conflict and high horsepower it is wise to make decisions in advance of a course of action rather than in the middle of it. In the present chapter we go beyond simple conflicts like grasping vs. not grasping and consider problems of a larger scale, such as a conflict between working and quitting, and between loving and hating.

THE INDIVIDUAL AT WORK

A familiar situation which involves both positive and negative motivation is the work situation. Saying that someone is at work means more than saying that he is active or that he is motivated. Working means accomplishing an assigned task. The worker gets set, not just to make responses, but to do a certain job. Thus the acts included in the task have a different meaning to the individual than reflexes, emotional responses, or playful acts. He ob-

serves his performance and evaluates it in relation to the assigned task. Finishing the job takes on special significance. The first question about work, then, is: How is the task assigned?

Assignment of Work

Primitive man did not work. When he was hungry, he hunted food. When he was cold or sleepy, he looked for shelter. Later he anticipated his needs by collecting and storing food and by building more durable shelters. In other words he assigned himself a task; he put himself to work. Instinct may drive birds to build nests and bees to store honey, but man recalls comforts and discomforts of the past and makes plans for the future. The concept of work implies orientation to an artificial goal, like completion of a job, which is often assigned by others and only indirectly related to immediate satisfactions and annoyances.

When social groups and societies were developed, different jobs were assigned to different people. The role of the leader, as one who assigns jobs, was differentiated from other roles. Social expectations about work were developed and preserved. In many societies, for example, men were expected to do the hunting and fighting; women were assigned the domestic jobs. In a complex industrial society like ours tasks are assigned by parents, teachers, and employers, as well as by the individual himself, all within the context of these social expectations. Educational tasks, or school work, are assigned by the teacher in accordance with social expectations, educational philosophies, and predictions about long-term goals, but for the student the immediate goal is completion of an assignment. In any case the individual is seldom working on a task that is directly rewarding. More often the task is one that he has to do to satisfy someone else or to satisfy his own long-term purposes. Whatever the ultimate motivation, most boys and girls and men and women are working a large share of every day.

The next question, then, is one of attitude toward work. How does the individual react to the task assigned him? The answer depends on dynamic factors discussed in Chapter 3 and especially the self concept discussed in Chapter 7. If the individual accepts the task as appropriate to his self concept and throws himself into his work, we say that he is self-involved or, more frequently, *ego involved*. This is the case when the task seems to be part of his mission in life, when it fits into his social role. Success will be a personal achievement; failure will be a blow to his self-esteem or ego. If the task is just another job to be done, of no special significance to the individual's concept of himself, he will not become ego involved. He may work hard at the job for a while, but failure will not bother him greatly, nor will success give him great personal satisfaction.

Consider the case of someone who undertakes to write a report, wash a car, bake a cake, or memorize a part for a play. Success in any of these tasks is an achievement, but the achievement is more important if the ego is involved in the task. One who considers himself an actor and believes that his mission in life is to "strut his stuff across the stage" will take the memorizing task as a personal matter. He will persist even if bored and even if interrupted. Ego involvement is reinforced by social expectations if he takes the job for pay. The same person who considers himself an actor may wash his car if he has to, but this will be a peripheral task, success in which is not central to his self-esteem. If there is no ego involvement in the task, he can fail without being a failure.

As another example, consider a housewife who faces a sinkful of dirty dishes. If she enjoys her role as a housewife and includes dishwashing as a part of this role, she will do the job without much complaint. Washing someone else's dishes in a restaurant for pay would be an entirely different job, but washing dishes after a PTA party might be an acceptable part of her concept of her self and her social role. If she rejects her role as a housewife and considers herself primarily a welder or an actress, washing dishes may be very disagreeable.

Some of the ego involvement depends, of course, on the social feedback, for the individual anticipates the effects of his work on others. "If I don't finish this, what will they think of me?" But it is not solely a social matter. "If I don't finish this, what will I think of myself?"

The way the task is assigned also influences the approach or orientation to the task. When the emphasis is put on completion of the job, either by oneself or by others, the individual is likely to be *task oriented*. He keeps his eye on the goal in spite of frustrations and interruptions. When the emphasis is put on competition with other people doing the same job, the individual often loses sight of the goal and becomes *self oriented*. He looks for opportunities to display his knowledge or skill, or to unload his troubles. Self orientation is not the same as ego involvement, as psychologists use these terms. The ego-involved person is all wrapped up in his work; the self-oriented person puts himself ahead of his work.

The Course of Work

What happens when a person accepts a task and works at it? Like other activities, this one can be described in respect to overt behavior, physiology, and consciousness. To some extent the three dependent variables go along together.

Performance or Output. When we study a person's work from this point of view, we are not interested in all his behavior but only in those responses

that are useful in reference to the task assigned. We are likely to use such words as "output," "performance," and "production," and to measure these in terms of number of objects assembled, painted, repaired, or inspected, number of letters typed, decisions made, and so on. Irrelevant activity, like conversation, is ignored, but errors, accidents, and wastage are recorded. Usually we study performance on a well-practiced task, so improvement due to practice will not confuse the picture. In general, the worker's output, measured in this way, fluctuates up and down as he goes along. A rapid increase in output at the beginning of a task, if it is not due to practice, is an indication of some kind of warm-up or initial adjustment to the situation. Occasionally an end spurt can be observed, just before quitting time.

When records are collected for a factory crew or an office staff over an eight-hour day, considerable variation in output appears, due to variations in attitude toward the task, expectations of employers and co-workers, and satisfactions received from the work, as well as to environmental distractions.² A warm-up effect is more common when the work is moderately heavy muscular work, as in Fig. 9.1, and dips in the middle of the forenoon

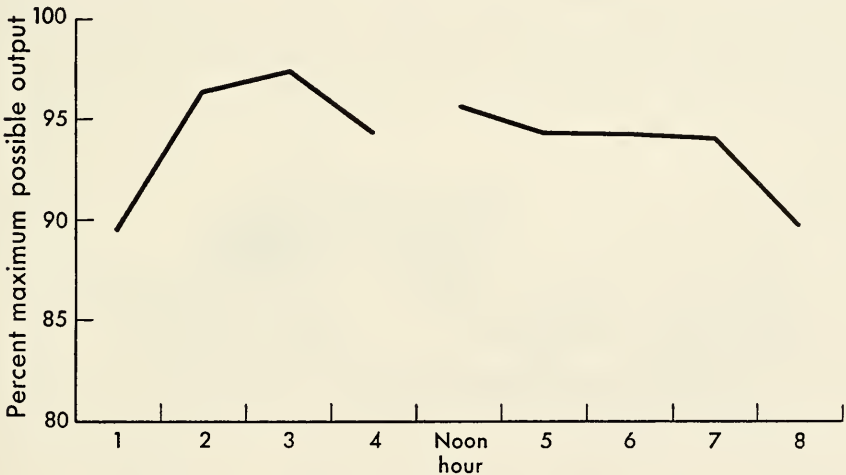


Fig. 9.1. Output curve for medium-heavy machine work. (From *Principles of Applied Psychology*, by A. T. Poffenberger [data from Goldmark and Hopkins], copyright, 1942, D. Appleton-Century Co., Inc. By permission of Appleton-Century-Crofts, Inc.)

and afternoon are more common when the work is repetitive and uninteresting, as in Fig. 9.2.

When the work is heavy muscular work near the capacity of the organism, the output eventually slows down and stops. This exhaustion seldom occurs except in emergency situations and indeed is hard to demonstrate in the laboratory because the body adjusts to the task by shifting muscles. It is possible, however, to exhaust the muscles of one finger by tying the

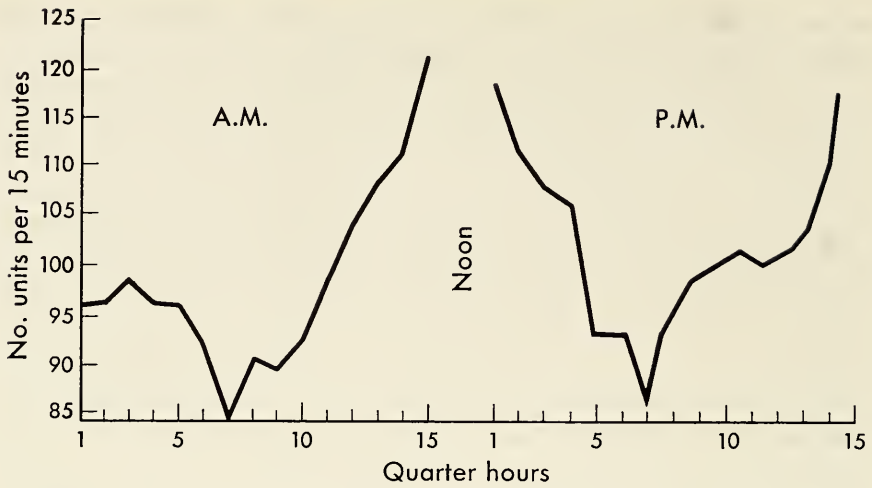


Fig. 9.2. Output curve for light repetitive work. (From *Principles of Applied Psychology*, by A. T. Poffenberger [data from Wyatt], copyright, 1942, D. Appleton-Century Co., Inc. By permission of Appleton-Century-Crofts, Inc.)

hand down to an instrument called an *ergograph* (see Fig. 9.3) and lifting a weight continuously by one finger. Fig. 9.4 shows that after one person lifted a 13-pound weight about 60 times with one finger, he gave out. The last few strokes were quite weak. In this experiment two other fingers were

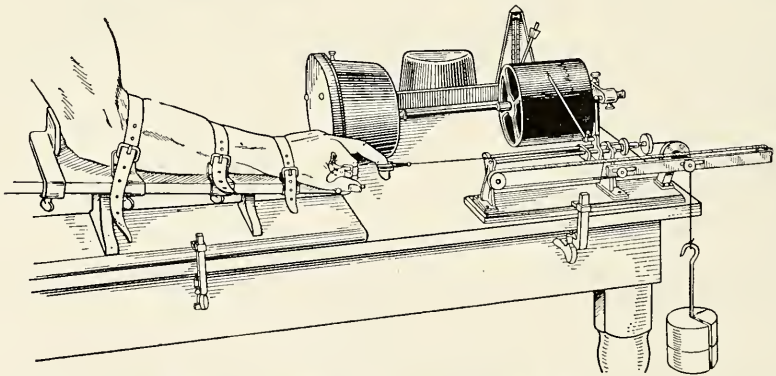


Fig. 9.3. Finger ergograph. (From J. F. Dashiell, *Fundamentals of general psychology*, Houghton Mifflin, 1949)

tied to springs that measured the work they were doing while the organism was adjusting to this exhausting task. At first the one finger operated smoothly and independently but as work continued and approached the limits of the organism, performance became less accurate and more irregular. Even before this point the activity spread to the other fingers and, near the end, the adjacent fingers were doing more work than the finger that started all this.³

Very few tasks, of course, make such strong muscular demands on the organism. The fluctuations of output in ordinary work are due not to exhaustion but to shifts of motivation and control of attention, so we must study tasks, at the opposite extreme from heavy muscular work, in which the response is easy and the difficulty is in maintaining vigilance. As this term is

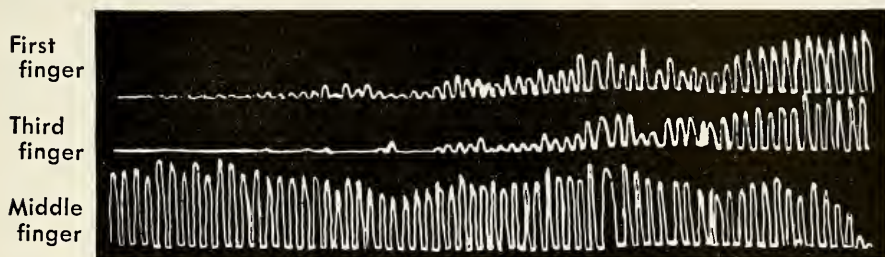


Fig. 9.4. Ergograph tracings for three fingers. The subject was instructed to pull the weight with his middle finger, and at the beginning the middle finger was doing about 5 foot-pounds of work in each block of five pulls while the others were doing nothing, but at the end the middle finger was doing about 1.4 foot-pounds and the others 2.1 and 1.8. (From Ash³)

used by psychologists,⁴ *vigilance* means “readiness to detect and respond to certain specified small changes occurring at random time intervals in the environment,” and this is the more serious problem in an age in which machines do the heavy work but man has to operate them and protect himself from them. Suppose you have to tend a machine for an hour or so with nothing to do but make an adjustment when the hum of the machine changes pitch a trifle. Or suppose you have to sit alone in a room watching dials, screens, and other indicators to detect any slight change in any of them. During a prolonged stretch on tasks of this kind, as in operating an automobile on a straight turnpike or an airplane in routine flight, errors increase even in the first hour. Reactions to signals are slower, unobtrusive signals, like the needle on the gasoline gauge, may be missed entirely, and adjustment of the controls becomes more erratic. Daydreaming is frequently reported.

In one experiment, for example, 20 subjects, one at a time, watched a small screen which was illuminated once a second, but occasionally the level of illumination was increased and on these occasions the subject had to push a button. The smallest increase that can be detected is what Chapter 4 called the difference threshold, and at the beginning, when the observers were fresh and eager, thresholds were quite small, but within a half-hour thresholds had risen considerably—sensitivity had declined. There are large individual differences in performance on such an uninteresting task even in the first 15 minutes. The better half of the subjects stabilized their performance after a short time while the poorer half continued to lose sensitivity for an hour and a half⁵ (see Fig. 9.5).

Physiology of Work. Work makes demands on the organism, as emotion does, and the level of activation is raised to meet these demands. Blood

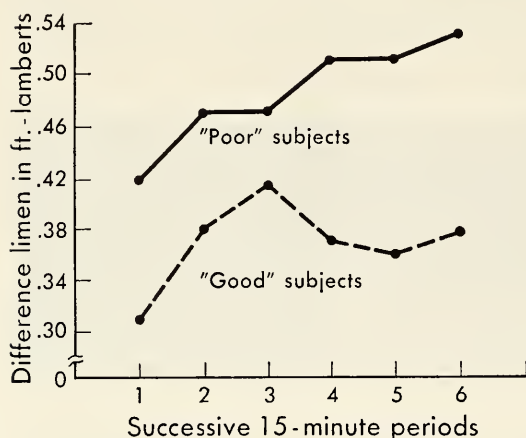


Fig. 9.5. Difference thresholds (or limens) for good and poor subjects during an hour and a half of continuous watching for a light to change slightly. (From Bakan⁵)

of work done. The oxygen necessary for burning the food cannot be stored very long, however, but must be breathed continuously. So the amount of oxygen consumed in a minute is a good measure of the energy output or activation of the organism during that minute, if other factors remain steady, and this can be converted to an estimate of energy expenditure in calories. Measurements with portable apparatus, like that shown in Fig. 9.6, yield estimates for a young 150-pound man in good condition of about 70 calories per hour when sleeping, about 80 when lying quietly awake, 100 calories per hour when sitting quietly, and 140 when driving a car. Skating at 11 miles per hour consumed energy at 640 calories per hour, while running at that speed required about twice as much energy.⁶ These estimates should be evaluated in reference to the total energy expenditure for the day, which for this young man might be around 4000 calories, and in the long run he eats about this much food per day.

pressure, muscle tension, pulse rate, and GSR increase, as during emotional excitement, and all of them can be used as measures of the amount of exertion. Furthermore, work requires energy, and the body has to make energy by burning food, just as a steam engine makes energy by burning coal. But the food is eaten at socially approved times and stored in the body until needed. So the food intake in any short period does not correspond to the amount



Fig. 9.6. Working on the treadmill. The apparatus on the subject's back collects breath samples for measurement of the energy used while running. (From H. J. Montoye)

Such measurements of level of activation and energy expenditure, called the *physiological cost of work*, are used to compare tasks and methods of performing these tasks. Arithmetic, as one might expect, takes more energy than reading.⁷ Work done on a table of the right height takes less energy than work done on a table that is too high or too low. But all tasks require more energy at first, when the skill is being acquired. Our young man who spends 140 calories per hour when driving a car probably spent 300 or 400 when he was learning. We have noted in previous chapters how learning is shown by the increase in output, and with constant output learning can also be shown by the decrease in the physiological cost of work.

Consciousness and Work. As the individual continues to work, he may report a variety of feelings. He may say that he enjoys the work. Or he may say that he is tired, fatigued, or dissatisfied. Strange as it may seem, these ups and downs in conscious feelings do not closely parallel the ups and downs in output. We cannot use the fluctuations in a person's feelings about his work as a guide to fluctuations in his performance. In a rough way consciousness may be taken as a signal of the condition of the organism, but it is not a good signal. Measures of variability of performance and errors are more dependable.

In offices and factories feelings about work and working conditions are often collected and studied under the name of *job satisfaction*. Job satisfaction inventories include such questions as:

Do you enjoy your work?

Do you have pleasant people to work with?

Does your supervisor get in your way?

Is your employer interested in what you do?

Are you paid as well as others doing similar work?

If you had your choice, would you pick some other line of work?

Job satisfaction in general depends on the nature of the work, especially the prestige of the job, social relations on the job, especially with the supervisor, and the individual's personal cheerfulness or satisfaction with life in general. Task-oriented groups report more satisfaction with their work than self-oriented groups.⁸ Research has shown that in some organizations job satisfaction is related to output but not in others. In any event, the two aspects of work should not be confused. Output has more immediate importance; job satisfaction may have long-term consequences, particularly in relation to absence and turnover.

The same principles apply to the work of the college student. In general the student who is interested in his work and satisfied with his role as a student learns more than one who thinks he ought to be playing some other role; he is absent from class less often and is less likely to quit and join the Army. But satisfaction and performance are not the same variables. There

are plenty of cases of students who were unhappy in college but learned a lot—and vice versa.

Moving up to high-level problem solving, what about the work satisfactions of creative scientists? The distinguishing feature of scientific workers is the heavy emphasis they put on intellectual rewards; when asked about work satisfactions, they reply in such terms as “good research facilities,” “recognition,” and “freedom.” The first requirement is obvious. The second means that they want their names attached to their creative output so they and their children and their colleagues will know who solved the problem. The third requirement means that a creative thinker wants freedom to choose the problem he is to work on and to formulate it from the beginning in his own way. At the extremes we can contrast the situation in some applied research organizations where a scientist has to work this week on a little segment of Project 437B and next week on Project N-82-p, and the situation in some universities where a scientist picks a problem that intrigues him and works on it to his heart’s content. When biological scientists were systematically asked about these things, those in the large industrial organizations complained mostly about lack of recognition and lack of freedom to follow their own hunches, while those in the universities complained about inadequate facilities and low salaries, but had a higher average research output.⁹

Conditions Affecting Output

Under ideal conditions the individual’s attention is concentrated on his assigned task and he makes satisfying progress toward completion. If all goes well, performance reaches high levels. Someone reading a good book, for example, may read steadily for two or three hours at 20,000 words per hour. A bricklayer may lay a thousand bricks a day. A typist may hit the keys 10,000 times a day. Three girls at the University of Southern California once multiplied four-place numbers, such as 7362×3595 , mentally 12 hours a day for 4 days.¹⁰

Usually, however, conditions are less than ideal. The individual may get very little done in an hour. He may quit. Typically the limiting factor in output is not the difficulty in making the response or in perceiving the stimuli. It is more often a matter of control of attention or orientation to the work or, in other words, maintenance of the set for the assigned task, and we know that these functions, like other bodily functions, fluctuate in efficiency from moment to moment.

The Working Environment. When a large number of people work in a small room for a while, they often get sleepy and work falls off. Research has shown that the important variable in this situation is temperature. People

may say that they need fresh air, but cooling the air or turning on a fan is just as effective in most situations. Humidity is indirectly involved also, because high humidity reduces evaporation of perspiration and thus interferes with the normal cooling function of the skin. A shortage of oxygen, as at high altitudes, also lowers performance on intellectual as well as muscular tasks. Many working environments include other disturbing factors such as poor illumination, uneven illumination including glare, noise, and vibration, any of which can reduce output or raise energy expenditure.

When one is trying to do something and his attention is drawn to something else, we call this effect *distraction*. The environmental stimuli that distract are the same as those (see Chapter 3) that attract attention: bright lights, loud noises, vibration, delicious gossip, etc. From the discussion in Chapter 7 of negative adaptation one would predict that the effects of distractions would soon extinguish, and research in factories and laboratories has shown that this usually happens, whether one measures output or physiological cost of work.² Naturally it is harder to adjust to more specific distractors: loud sounds when one is trying to tune a violin, glare originating near the object of inspection, vibration when one is trying to aim a weapon.

Motivational Conditions. Certainly output depends on the dynamic factors discussed in Chapters 2 and 3 as well as the ego involvement, social expectation, and job satisfaction discussed above. In addition, as one gets into a job, whatever the motivation that started him, he may find new satisfactions in the work and may take pride, even aesthetic satisfaction, in his output. Work that was once just a means to an end may become attractive in itself, and after a workman retires, he may itch to get his hands on his tools again. Even if the work is not actually enjoyable, one often notices variations in the work or introduces variations in work methods and thus maintains a fair level of motivation. If all these dynamic factors are integrated in the same direction, output will be high.

On the other hand, during repetitive work a negative motivation or resistance to work may build up, particularly if the work demands continuous attention but does not offer any challenge, as in driving a car on the open highway, operating a semiautomatic machine, or reading Chaucer for several hours. One usually avoids such an unpleasant task, as one avoids unpleasant food, but if he forces himself to continue because it is part of an assignment that he has accepted for reasons mentioned above, he describes the work as monotonous and reports feelings of boredom. He is in a conflict between continuing and quitting. The dip in output in the middle of a work period, as in Fig. 9.2, and the increase in errors, accidents, and missed signals are usually attributed to the accumulation of some such negative motivation. As quitting time approaches, output picks up and boredom disappears. This is not a matter of long-term overall motivation. No automobile

driver or machine operator wants an accident. The difficulty is one of short-term orientation of one's abilities to the immediate task.

Work Schedule. All the effects of continuous work—the decline in output, the surplus physiological cost, and the feelings of boredom and weariness—are eliminated by rest. If the work continues until exhaustion, a long rest is necessary for full recovery. A more efficient schedule introduces short rest pauses often, beginning just before output starts to decline.

If a good work schedule is incorporated in the task, the negative motivation does not build up so much. Watching an indicator for an hour or so with only an occasional warning signal to respond to is a monotonous task, but when the number of signals was increased from 10 per hour to 40 per hour, accuracy in detecting the signals increased from 45 percent to 90 percent.¹¹ On monotonous tasks almost any kind of stimulation or any kind of response, whether related to the assigned task or not, maintains the level of activity and reduces errors as long as it does not interfere with attending to the signals.

Compensation. Output or performance can be considered a dependent variable related to each of the conditions listed above, plus others not included. Not all the facts fit into this simple linear scheme, however, because output may be a reaction to output itself. When output is low, the individual may speed up. If the norm for bricklayers is a thousand per day, a conforming bricklayer who has laid 900 bricks by two o'clock slows down regardless of working conditions. Or, if he is behind the norm, he speeds up in spite of unfavorable conditions.

This compensatory reaction appears prominently in a distracting environment. If the individual's motivation is weak, almost any distraction will pull him away from his work. But if he is highly motivated, he will react against a decline in output and continue to put out the work even though the room is too hot, the light is too weak, doors are slamming, radios are blaring, his head is aching, the baby is crying, and owls are hooting in the chimney. Furthermore, under some conditions, even though the individual is doing work of no personal interest, he takes the distraction as a kind of game, a challenge to his self concept. When such ego motivation is aroused, he compensates by working harder and producing as much as under control conditions. We can prove, however, that he has to work harder under distracting conditions to produce the same output. The muscles are more tense, more oxygen is consumed, and in general the physiological cost of work is higher—at least until he adapts to the distraction.²

Raising Output. All these conditions of work can be manipulated in order to get more work out of oneself or others. Physical conditions are easy to manipulate; psychological conditions are hard to manipulate—and much more influential.

Improving the temperature by ventilation, better heating, or air conditioning often increases work output. Improving lighting may help, especially reducing glare. When the work is simple repetitive work, music may reduce boredom. Research in industry has shown that these improvements often have a secondary effect of increasing work satisfaction. Employees enjoy the job more if they believe management is trying to improve their working conditions. Output may or may not decrease, but absence and turnover are likely to decrease, especially if the improvements are initiated by the employees.

When one is trying to get more work out of himself, manipulation of the work schedule is well worth a trial. When driving a car or studying for an examination rest pauses should be systematically introduced. Work should be scheduled in advance so there is time for adequate rest periods. Study an hour, then walk around the block, then come back—this may be the hard part—and study another hour. Many people report difficulty in working at certain times, for example, just after eating or just after a two-hour class. Schedule muscular work for these low periods and schedule important intellectual work for the most efficient times of the day and for times when distraction can be minimized.

Another procedure for handling distraction is the alternation procedure. Instead of studying and talking simultaneously—and not doing either well—it is better to study a while and then talk a while. An on-off division of effort is more efficient than a side-by-side division. On the other hand, if the task is an easy monotonous task, boredom is reduced and output stabilized by permitting conversation, or by background music.

Individual Differences

There are differences between individuals on all aspects of work discussed in this chapter, and there are methods for comparing individuals on some of these differences.

Amount of interest in a task can be measured by tests of interests and values, described in Chapter 3, and such tests do predict how well people will do in certain occupations. Job satisfaction is measured by printed inventories of questions, a few of which were shown earlier in this chapter. When groups of people work together, as on a committee, those who are most task oriented and those who are most self oriented can be identified by analysis of their conversation.⁸ The self-oriented person habitually uses the job to advance himself and thus he finds it hard to work as a member of a team and subordinate himself to group action. The task-oriented person talks more about the job than about himself, but the self-oriented person uses the pronoun *I* frequently.

The important ability in some jobs is the ability to control attention, especially for continuous work under distracting conditions. A test for comparing individuals on this ability may be a tape or a phonograph recording which delivers a series of stimuli, some of which are to be identified and some to be ignored. Research with such tests always uncovers large individual differences in susceptibility to distraction and to boredom, as in Fig. 9.5.

In many of life's competitions the winner is the one who persists after others have quit. Regardless of how the activity gets started, some people keep going to completion in spite of discomfort and bad working conditions, while others seize any excuse to stop work. Tests of this motivational factor require people to work on unrewarding tasks like reading badly printed words and deciphering a difficult code. The score is not the number done right but the time spent before giving up. Students who persist on such tasks spend more hours studying and get higher grades than students of equal academic ability who give up easily.¹² Those individuals who direct their behavior steadily toward long-term goals consistent with their self concepts are said to have good *self-control*, while those who are sidetracked by immediate environmental stimuli or distractions are said to lack self-control.

PRACTICE PROBLEMS

1. A famous philosopher once said that the _____ is a durable institution because it integrates the operation of several motives under one roof. What institution did he have in the blank?
2. College students sometimes work harder on extracurricular activities, e.g., a Class Day parade, than on their studies. Why? (a) Persistence; (b) physiological cost of work; (c) attention span; (d) self orientation; (e) ego involvement.
3. The word "fatigue" is confusing because it may refer to change in output, physiological change, or conscious feelings, as well as other things. What other psychological concept is confusing in the same way? (a) Reflex; (b) efficiency; (c) emotion; (d) ego; (e) value.
4. Two groups of college students are given some problems to solve, but Group A is told that these are part of an intelligence test and the score will predict success in college while Group B is asked to do them just to see how long it takes. Which group will be more frustrated by failure? Why?
5. In respect to the variables influencing attention and distraction the college classroom is most similar to what other working environment? (a) Basketball game; (b) church; (c) library; (d) dinner table; (e) department store.
6. "Man is a machine." This statement starts interesting arguments, but if you could make only one comment, which of these would be the best?
 - a. This is true for lower animals, but not for man.
 - b. Man is human; machines are inhuman.
 - c. The statement is correct but incomplete.
 - d. The principles of human behavior are different from mechanical principles.
7. If you wanted to study the effects of learning on the physiological cost of work, what would be a suitable dependent variable? independent variable?

8. Under what conditions is the physical definition of work most useful to psychology?
9. Efficiency is often measured by a ratio: $E = \frac{\text{output}}{?}$. If the ratio is applied to the behavior of human organisms, what objective measure would be appropriate for the denominator?

RELATIVE IMPORTANCE OF TEN WORKING CONDITIONS

Each individual in several occupational groups checked the three items he considered most important. The figures give the percentage of each group who rated the item one of the three most important.

	Percent				
	President	Office Worker	Physician	Artist	Carpenter
Freedom in working out one's own methods of doing the work	66	42	65		
Opportunity to make use of all one's knowledge and experience	68	40	76		
Steadiness and permanence of work	30	45	35		
Opportunity for promotion	34	63	21		
Salary received for work	30	31	23		
Certainty one's work will be judged by fair standards	20	21	22		
Co-workers—congenial, competent, and adequate number	38	22	26	14	10
Courteous treatment from superiors	5	18	6		
Opportunity to ask questions and to consult about difficulties	9	10	19	8	13
Opportunity to understand just how one's superior expects work to be done	3	9	1		

* From *Psychological aspects of business* by E. K. Strong, McGraw-Hill, 1938.

Several blanks have been left in the table. From your knowledge of artists and carpenters and of motivation for work would you expect that "freedom in working out one's own methods of doing the work" would be more important to artists than to carpenters? If so, answer Question 10 by putting A in the blank. Answer the others in the same way, by writing A if you think the item is more important to artists than to carpenters, and C if you think it is more important to carpenters than to artists.

- | | |
|----------------------------------|-----------------------------------|
| 10. ____ Freedom. | 14. ____ Salary. |
| 11. ____ Opportunity, knowledge. | 15. ____ Certainty, standards. |
| 12. ____ Steadiness. | 16. ____ Courteous treatment. |
| 13. ____ Opportunity, promotion. | 17. ____ Opportunity, understand. |

18. Which of these concepts from Chapter 2 is most similar in operation to compensation? (a) Instinct; (b) survival value; (c) psychodynamics; (d) homeostasis; (e) preparatory activity.

FRUSTRATION AND CONFLICT

Some behavior patterns are characterized not so much by action toward something as by reaction *against* something. A man may work long hours on the job, not because he likes the job but because he is unhappy when he goes home. A boy may beat up his little brother because he is mad at the big boy next door. A girl may marry John because she did not get Harry. A human being is a going concern, with momentum and resilience, and when one bumps into an obstacle, he may bounce back in almost any direction. It is worth while, therefore, to describe a few typical reaction patterns, what people react against, and what directions reactions take. One who learns to identify these reactions when he sees them in his friends can understand and sympathize with them and can perhaps predict their behavior. If he can identify these reactions in himself, he can understand his own behavior better and can perhaps live more peaceably with himself.

The events against which people react most frequently are frustrations and conflicts. (Recall how a motive operates. There is an increase in level of activity, preparatory activity is directed toward the goal object, and finally the goal response is made and activity level returns to normal. Usually but not always there is a conscious desire for the goal object. If all these things happen except the goal response, activity level remains high and we say the person is *frustrated*.) In other words, a person is frustrated when he is motivated toward a goal but something blocks his progress toward that goal.

What are the barriers that interfere with attainment of the goal? Sometimes the barriers are in the external environment. A child wants the jar of jam he sees on the shelf but cannot reach it. A boy wants the bicycle he admires through the shop window but it costs \$35 and he has saved only \$4.37. Any failure or inability to reach a goal, even an abstract goal like a promotion, can be frustrating, especially if the individual almost has it within his grasp or has been led to believe he will get it. This situation can be mapped as in Fig. 9.7, in which P is the motivated person or organism, the arrow shows the direction of the motive, the rectangle is the barrier, and G is the goal.

Sometimes the barrier to the completion of the preparatory activity initiated by the motive is not an obstacle in the environment but another motive within the person. Motives like achievement and sex are often incompatible with the motive for social approval. A manufacturer with an expanding business wants to build a larger factory but he fears community disapproval

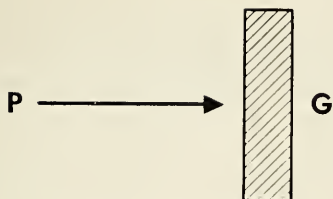


Fig. 9.7. Frustration.



Fig. 9.8. Approach-avoidance conflict.

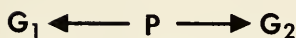


Fig. 9.9. Approach-approach conflict.

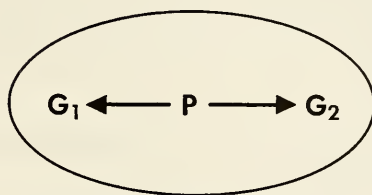


Fig. 9.10. Avoidance-avoidance conflict.

of the noise and smoke. A druggist can do a good business in comic books but he fears the PTA ladies will complain to his wife about some of his merchandise. A girl is attracted to a boy whom her friends disapprove. When someone is aroused by two incompatible motives, we can say that one motive is frustrated by another or we can say that he has a *conflict of motives*. He is motivated to approach the goal and also to stay away from it. A conflict of this type is called an approach-avoidance conflict. It may be mapped as in Fig. 9.8. Another type of conflict is the approach-approach conflict, as in Fig. 9.9. A person wants to go to the movies tonight but he also wants to stay in and study. A girl wants to marry a certain young man but she also wants to spend a year in Paris before she settles down. Another type of conflict is the avoidance-avoidance conflict. A boy wants to quit school but he fears social disapproval of quitting, so he does not attend classes seriously and does not actually quit. A woman hates her husband and wants to leave him, but the consequences of leaving him are not pleasant either, so she avoids both the husband and the separation (see Fig. 9.10). Obviously the avoidance-avoidance condition is not a conflict unless there are restrictions that keep the person near the things he is avoiding.

All these frustrations and conflicts can be called personal problems in contrast to the more intellectual or impersonal problems discussed in the preceding chapter. Both the problems and their solutions are peculiar to the individual; there are no right answers in the back of the book. We can call the outcome bad only if it interferes with the individual's happiness or his work output. The external behavior of someone who has an internal conflict,

whatever it is, may not reveal anything but an increase in general activity or tension, or a decline in work performance. People do not usually communicate their feelings about these things with complete frankness, as noted in Chapter 3, so inferences about frustrations and conflicts must be made cautiously. We cannot say that frustration of Type A is always followed by a reaction of Type A' or that a conflict of Type B is always followed by a reaction of Type B', but the next two sections describe a few of the most common reactions to the most common frustrations and conflicts, most of which were first described by Sigmund Freud, the great psychoanalyst. The practice problems will give the reader a chance to try out his psychological insight.

CONSEQUENCES OF FRUSTRATION AND CONFLICT

Most people settle most of their personal problems tolerably well. The frustration increases general activity and focuses attention on the problem. The frustrated individual tries one thing after another—as described in the preceding chapter—and usually achieves a solution that relieves the frustration. But when the frustrated motives are strong and the frustration is accentuated by ego involvement in the goals not achieved, solution may be delayed and strong emotion aroused. Experimentally arranged failures in the laboratory are nearly always followed by increases in heart rate and GSR.¹³ Anxiety often develops secondarily when the individual feels the rising tensions and fears that he will be overwhelmed by his inadequacies. This anxiety is not a pleasant emotion, like the rapture of summer love or the thrill of skiing downhill, but an unpleasant emotion that we try to avoid. So the consequence of frustration may be, not a solution to the original problem, but an attempt to reduce the anxiety it caused.

Anyone who likes to study people can observe a great variety of reactions to frustration. A person may delay a while, then take another look at his predicament and decide that one of his goals is more important than the others. Some prefer a social strategy, talking to people until the balance of motives tips one way or the other. If the individual believes that the conflict is making him too unhappy or is cutting down his efficiency, he may devote some serious thought to it and restructure the whole problem in relation to his long-term goals or shift set and produce some different kinds of possible solutions.

Many reactions to frustration can be described in a general way as *substitutions*. If someone is frustrated when he asks for raspberry ice cream, he may take strawberry ice cream. If a girl is trying to make the grade as a singer and fails, she may be satisfied to be an actress—or vice versa. If a boy cannot get a date with Mary Lou, he may telephone Anna Lou. One goal

object may substitute for another of the same general class of objects. On the other hand, some goals are very specific. A connoisseur will not accept substitutes. Most goals are learned goals, of course, and some kinds of learning promote generalization while other kinds promote narrowing of goals. If a child is taught to eat only certain things and not others, if he is allowed to play with certain children and not others, if he is approved for certain activities and not others, he will learn to be hard to satisfy.

A common type of conflict is the approach-avoidance conflict between aggression and social approval. A man gets mad at his boss and feels like beating him up. But this is not done. So he goes to the gymnasium and takes it out on the punching bag. When a goal activity that is socially approved is substituted for one that is socially disapproved, e.g., sex, this kind of substitution is called *sublimation*. Another example is the case of the unmarried woman who desires to possess and care for a child. She may sublimate her frustrated desire by teaching a kindergarten class. Thus it happens that new goals, new interests, new values and attitudes may be acquired as substitutes for unattainable goals.

The reaction to frustration may be the same as a previous reaction to frustration if the previous reaction was suitably reinforced. If the person learns a habit that solved his problem, he is no longer frustrated, but the habit he learns may be a reaction to the frustration itself rather than a solution of the original problem. Temporary reduction of the anxiety connected with frustration seems to reinforce the learning of all kinds of habits of reacting to frustration, such as playing handball, buying a new dress, going fishing, and drinking alcohol. Children, and even some adults, react to frustration by throwing a temper tantrum, and this too may become a habitual reaction if it is socially rewarded.

Without saying what direction the reaction to frustration takes, we can say that the strong emotion usually lowers the quality of the performance. When people get into serious trouble, they often become so excited that they make fools out of themselves. Or at least they perform at less than maximal efficiency. We have seen in previous chapters that when one is learning something difficult or trying to solve a problem, strong emotion is usually followed by a loss of flexibility and a deterioration of performance.

This principle has been strikingly demonstrated by the performance of young children who were experimentally frustrated. They were first allowed to play with ordinary toys, which they did in the ordinary way. Then they were allowed to step into the next room and play with some super-extra-special toys: brightly colored tables, chairs, boats, and a pond of real water. Later, when they came back to play, they could see the special toys but could not touch them. That is what was frustrating. They did play with the ordinary toys, but their play was less adequate, less constructive than before

they were frustrated. For example, a boy who had used a toy telephone in an adult way to carry on an imaginary conversation now used it just to bang on the table. A girl who had been pretending to iron clothes on the toy ironing board now just knocked the board down. On the average the level of constructiveness of the behavior of these children dropped down to the level of children one or two years younger¹⁴ (see Fig. 9.11).

In general, it appears that a mild degree of frustration peps up activity and may improve performance. At least it keeps people alert. Severe frustration usually lowers the quality of performance, especially if the task is complex. The same general statements can be made about the effects of different degrees of anxiety. The next question is one of direction: What directions do people take when reacting against frustration and conflict?

Frustration and Aggression

Aggression is a common form of reaction to frustration. Take a bone away from a hungry dog and see what happens. Or stand in front of a lioness looking for her lost cub. Aggression is a common reaction to frustration; and, in reverse, when anyone is unusually aggressive, some frustration in his background can probably be discovered. When children are experimentally frustrated in the laboratory, not only do they become less constructive, they often become more aggressive toward the one who seems to be frustrating them. Furthermore, if the frustration is repeated, the number of aggressive responses increases.¹⁵

We can call aggression a reactive motive because it originates as a reaction against frustration and because it operates like the other social motives discussed in Chapter 3. The goal is to injure someone. In any particular situation aggressive behavior, like any other pattern of behavior, depends on factors in the individual, such as the aggression motive, and stimulus factors in the external environment. Among the important factors in the individual is the influence of prior training, for a child who has been rewarded in any way for aggressive behavior is not likely to inhibit aggression. Among the factors in the present situation the frustrating stimulus object usually attracts attention and the aggression is directed toward this object, as when a dog with a bone attacks another dog that tries to steal it, or when a grocer launches verbal attacks on the supermarket that is ruining his business.

In more complex situations identification of a suitable stimulus object to attack is not so easy. The frustration may come from some impersonal abstraction like bad weather or inflation. Or the frustrating agent may be too dangerous to attack, as when the dog's bone is stolen by a bigger dog. Or the frustration may come from the person's own acts or failure to act, identification of which is repressed. In these cases the person may be frustrated and angry without a clear-cut stimulus object on which to focus his anger.



Fig. 9.11. How to frustrate children. The children were first allowed to play with the very attractive house and toys (above). Later the glass screen was lowered (below), so the children could still see the shiny toys but could not play with them. They played with the second-rate objects shown in the foreground, at a lower level of constructiveness. (From Barker, Dembo, & Lewin¹⁴)

But the objects in the environment are not all alike. Some are more annoying than others because of past experiences, and the reactive aggression adds to any existing hostility. It is possible to train a rat to fight another rat and then to shift its aggression to a celluloid doll by proper timing of annoying stimulation, as Fig. 9.12 shows.¹⁶ The substitution of one object of aggression for another is called *displacement*.

Different people displace their aggression in different ways, but two important factors that shape this reactive pattern of action for many people are the tradition and the leadership. There may be a traditional scapegoat in the culture that children learn about as they grow up. In the cities, for example, when people are bitter, they frequently blame the farmers. Farmers commonly blame their troubles on the Wall Street bankers. It is traditional in business circles to blame the labor unions. Others pick on other scapegoats. "It's the bureaucrats." "The Jews have all the money." "The Negroes are getting all the good jobs." "The foreigners are ruining our markets." Those who have been disciplined for aggression and feel anxious about their hostility probably are less anxious when they believe the crowd is with them.

Displacement of hostility is influenced also by a skillful leader or propagandist. Resentments from different sources can be channeled by a temporary leader into aggressive political action or even mob violence. Leaders who capitalize on discontent in this way are called *demagogues*.

Usually the aggression is directed outward, toward other people or things, but occasionally someone directs his aggression inward, on himself. This reaction is most often verbal: "What a stupid mistake. I could shoot myself!" But some people carry self-punishment so far as to torture themselves or even to commit suicide.

Reactive aggression should not be confused with the achievement motive. In the present sense aggression means intent to do harm, but in other con-

texts the adjective "aggressive" is used as a synonym for "energetic" or "ambitious." When someone is described as an aggressive salesman, we need not assume that he is angry at anyone, certainly not at a prospective customer.

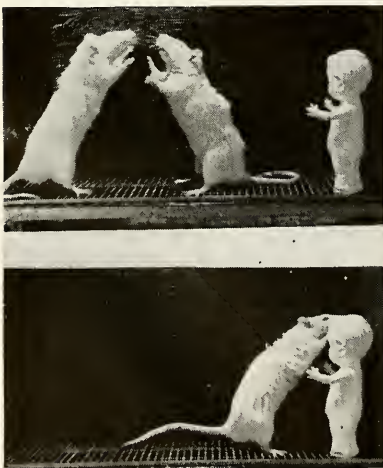


Fig. 9.12. Displacement of aggression. Two rats were placed in a small box with an electrified floor, and whenever one struck at the other, the experimenter rewarded them by turning off the current. Twelve rats which had learned this aggressive habit were placed in the box one at a time, without a rat to fight, and when the current was turned on, 11 out of 12 displaced their aggression onto the celluloid doll standing innocently in the corner. (From Miller¹⁶)

He may merely be trying to sell a lot of snowplows and win a trip to Bermuda. Only the bullying, resentful kind of aggressive behavior is a reaction to frustration.

Dependency

Another kind of reaction to the frustrations and conflicts that threaten us on all sides is to seek a social situation which offers protection. This reaction runs counter to such motives as achievement and aggression; it is a kind of withdrawal or avoidance of independent action and initiative. A dependent person tries to attach himself to a strong character who will soften the shocks of life. In research with young children such behavior as seeking contact, attention, help, and praise from parents and teachers is recorded as a mark of dependency.¹⁷ In older children dependency shows up in the form of leaning on other boys and girls, waiting for others to move first. A man who is seeking protection may marry a dominant woman who appears able to shelter him and make his decisions for him. He may seek a soft job where he is assured of three meals a day and does not have to solve any troublesome problems. He will probably resist promotion to a job of increased responsibility.

Such dependency is learned in social interactions of the past, just as achievement and aggressiveness are. Dependency is acquired from prolonged illness in childhood, from repeated failures in the struggle for achievement, and especially from an overprotective family situation. A mother may protect a child more than usual as a reaction to the hard struggle she had when she was young. A father may reject the child because he does not have the appearance, or the abilities, or the interests that he had hoped for in a child, or perhaps because the child was not wanted at all. Then he may feel guilty about this rejection and react by shielding the child and preventing him from meeting his own frustrations. When the child grows up, the event that arouses the dependency reaction is the perception or anticipation of frustration or some other kind of trouble. The goal is a close relationship with another person who will take over the responsibility.

Fantasy

All motives, biological, acquired, and reactive, may include a conscious aspect. The motivated individual prepares for the goal activity and may anticipate it in imagination, with pleasure or perhaps anxiety, before he takes any action at all. This is called *fantasy*. If there is a frustrating barrier between him and the goal, the fantasy may be the only thing he does.

Obviously we cannot observe his fantasies. But we can ask him to tell us his hopes, his daydreams, his fears. Or we can get at them indirectly and perhaps more frankly by telling him the beginning of a story and asking him to finish it. We can show him a picture that is not quite clear and ask him to tell a story about it. Children's fantasies may be explored by giving them some dolls and toy furniture and asking them to use these to tell a story. Or we can ask them to draw pictures. All of these methods are based on the assumption that the subject will use the material we give him only as a starter and will weave his own fantasies into the story he tells. This is the same assumption we made in Chapter 3 when we used fantasies as signs of achievement motivation.

Telling stories with words or dolls is an imaginative activity that requires some intellectual ability as well as motivation, and perhaps some dramatic ability as well. But the distinguishing feature of fantasy is that it is not punished as overt behavior is. Children who are punished severely for aggression may later show less overt aggressive behavior than other children but they show more aggressive fantasies in doll play.¹⁸ When people are arbitrarily insulted or frustrated in the psychology laboratory, their behavior may be as polite as usual but if given an opportunity they will write aggressive stories or draw aggressive pictures. Drawings of a psychologist hanging from the ceiling are a common result of this kind of experiment. Dependent people often react to frustration by fantasies of finding a true friend, a real savior.

PRACTICE PROBLEMS

19. An animal in the obstruction box of Chapter 2 could be said to be in a conflict of (a) approach-approach; (b) approach-avoidance; (c) avoidance-avoidance.
20. Some conflicts are handled by an alternation or change-of-activity technique. Which is most suitable for this strategy? (a) Approach-approach; (b) approach-avoidance; (c) avoidance-avoidance.
21. Suppose we train a rat to press a bar for food, then we put electric shock in the bar. The rat's conflict is of which type?
22. What would you predict that a rat in such a situation will do?
 - a. Rat does not move.
 - b. Rat walks slowly toward the bar.
 - c. Rat runs to bar, then backs away.
 - d. Rat runs to bar but does not eat the food.
23. The girl who made the ratings of foods listed on p. 62 was once given a choice between a liverwurst sandwich and garlic toast; later she had a choice between biscuit with honey and apple pie. Which choice required more time?
24. If we apply the terminology of this chapter to Problem 23, it would be called a comparison of (a) two approach-approach conflicts; (b) two approach-avoidance conflicts; (c) an approach-approach and an approach-avoidance conflict;

(d) two avoidance-avoidance conflicts; (e) an avoidance-avoidance and an approach-approach conflict.

25. The reaction to some conflicts is to run away from the conflict situation and everything in it. Which type of conflict is most likely to have this result?

The diagrams of Fig. 9.13 are intended to map four types of reaction to frustration: AO, aggression directed outward; AI, aggression directed inward toward the self; F, fantasy; PS, intellectual or problem-solving reaction. Which is which?

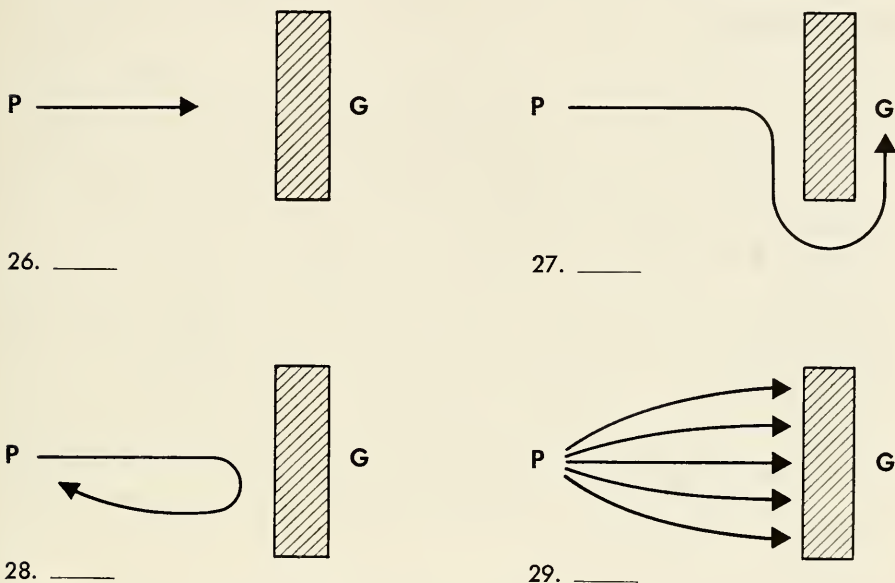


Fig. 9.13. Four types of reaction to frustration.

CONVERSATION PRECEDING THE RUMMAGE SALE

MRS. HARRIS: Put all the children's things on this table. The hats go on the table by that mirror and the shoes by that bench so they can try them on.

MRS. STONE: Did you bring this cute hat, Mamie? How does it look on me?

MRS. HARRIS: Fine, and you'll get first chance to buy it after everything is sorted.

MRS. LITTLE: Our church group is helping a Mexican family. Would it be all right if I take a few things for them before the sale starts?

MRS. HARRIS: You'd better wait till the sale is over. There will be a lot of things left.

MRS. LITTLE (*aside to Mrs. Stone*): Mamie is so money-mad, she forgets who her friends are.

MRS. DE GIACOMO (*to Mrs. Barclay*): Here they come. I'll stay near you so you can help me with the prices.

MRS. LITTLE: Where's Flora? She always votes to have these rummage sales, but she never shows up to help.

MRS. HARRIS: I wonder if we have enough change.

MRS. DE GIACOMO: Oh dear. My husband does the arithmetic in our family.

MRS. STONE: I was the cashier at last year's rummage sale.

MRS. SENF: I don't know what I am supposed to do.

30. If you had to rate these women on the basis of their conversation, who would get the highest score for aggression?
31. Who would get the highest score for dependency?
32. Who shows the most task orientation?
33. Who shows the most self orientation?

EGO DEFENSES

In Chapter 7 we examined the self concept and the ego motivation that revolves around it. Several common patterns of action appear to be reactions against a special kind of frustration, namely, a threat to the self concept. A person builds up a self concept or ego that he is proud of; then, as the pressures of a competitive world bear down on him, this cherished picture of himself is threatened and he becomes anxious. He commits himself to achieving a goal, then fails. He looks in his heart and is ashamed of some of his motives; he fears that he may not be able to control himself. His friends comment, or he thinks they comment, on his inadequacy. It is not a question of real inferiority, but of feelings of inferiority. When the ego is threatened in this way, most normal people do not take it lying down; they react against the threat one way or another. The reactions that defend the self concept against threat and reduce anxiety are often called defense mechanisms or *ego defenses*.

Compensation and Overcompensation

Earlier in this chapter we saw how a person may compensate for inadequate performance—inadequate, that is, in reference to his self concept—by working harder. When a person loses self-esteem, as when he is caught in a position he is ashamed of, he may compensate psychologically. In general the activity level is increased and behavior is oriented toward restoration of the cherished self concept.

Hattie S., the youngest in a family of four, came to college from a small town in central Illinois. She was jolly and rather attractive. She made many friends in college. She ran for president of the sophomore class and won a good share of the vote, though she did not get elected. Her grades were mostly C's, with a few B's. She did not dislike her courses; neither did she particularly like any. Her chief interest was in her friendships, and she considered herself a social success.

After graduation she worked as an airline hostess. This was fun for a while. Two years later she got married and quit work. There was the usual excitement of the wedding, and setting up housekeeping, and making new friends.

Her husband, however, was not well and did not like to go out much. They had no children when he died and left her a widow at the age of 36.

She went back to live with her parents but was not happy. The social life in the small town revolved around family affairs. She returned to the airline company for a job, but they told her as tactfully as they could that they preferred younger girls. She had told the Employment Manager that she was 29, but it was easy to see that he did not believe her. She came back home and took a good long look at herself in the mirror. The next week she dyed her hair, bought a bright red dress, and took the money her husband had left her and bought a secondhand sport roadster. She was frequently seen hot-rod-ding around town with the top down, and people talked about the fast life she was leading.

Why is this considered an example of compensation?

Since the ego can be threatened in many ways by the insecurities of modern life, and since different people define success in different ways, compensatory efforts take many forms. If a person makes a disturbing blunder in a business deal, he may compensate in kind: go right back to work and fight even harder for dear old Acme Products, Inc. Or he may try to mend his tattered ego by achievement in some oblique direction: by talking about his former accomplishments, by teaching his son how to be successful in business, by bullying his wife, or by practicing harder on his golf game in the hope of winning the annual tournament. When a boy has been told, or suspects, that he looks like a girl, he may compensate by growing a mustache, by smoking a pipe, or by some other masculine activity.

It is a curious bent in human nature that, when people compensate, they often overcompensate. Unsatisfied with regaining equilibrium, they press on toward greater and even impossible heights. Apparently the emotion activated by the threat makes them rigid, unable to bend to the realities of social interaction. Hitler, the unsuccessful paper hanger, was not willing to stop when he became dictator of Germany. He wanted to be dictator of the world. A girl who fears losing friends will often make extreme, even silly attempts at friendship. A man who fears growing old may make exaggerated efforts at youthfulness. The intensity of the motivation seems to inhibit the normal self-criticism.

Rationalization

Nicholas Jordan, a moderately prosperous automobile dealer, who thinks he has many friends in his district, told his wife one day that he was thinking of running for the state senate. A few weeks later he came home and told her that he had talked to the chairman of his party organization, that politics is dirty business, and that he would stick to selling automobiles.

Of course we do not know all about Mr. Jordan's motivation or his relations with his wife, but this could be an illustration of rationalization. If the

party chairman told Mr. Jordan that he was an unpopular man who could not get many votes, it would be a blow to his ego. Rather than admit this to his wife, he rationalizes, that is, he invents another reason. He says politics is dirty business.

Note that rationalizing is not the same as being reasonable. It means defending one's ego by supplying a reasonable motive for one's actions. If a girl quits school because she is homesick, she may say that she thinks school is a waste of time for girls, or give some other excuse for her action. The rationalization is a face-saving or ego-defending mechanism, and Chapter 8 showed how this reaction can motivate sophisticated imaginative thinking. Rationalization may extend to actions as well as words, as when one coughs to cover up a belch, and may be carried out so cleverly that, in outwitting others, one succeeds in deceiving himself.

Projection

Melvin Soran grew up in downtown Brooklyn, played with the other kids his age and seemed like a regular fellow. He was well built and enjoyed wrestling and horsing around with the other boys. When he was a senior in high school and other fellows were collecting pictures of girls, he collected pictures of sun-tanned muscular young men in bathing trunks. He occasionally dreamed of falling into the river and being rescued by one of these shining young men. His friend, Boris, teased him about being afraid of girls and got him a date with a girl from the neighborhood, but he felt uncomfortable all evening. He began to wonder if he was different from other boys. One day at Jones Beach he saw a handsome young man watching him. He went over and picked a fight with him. In police court later he told the judge that the other fellow made a homosexual proposition to him. "So I showed him I am not that kind of a guy." Case dismissed with a warning.

When someone feels guilty about something, he may defend himself by projecting the guilt onto someone else. The case of Melvin seems to be a severe, almost pathological, case of projection. Apparently Melvin felt guilty about his sexual motives, so he projected these motives onto the other fellow and then attacked him.

Most instances of projection are much milder. When Melvin's father made out his income tax report, he cheated a little, felt guilty about it, and remarked to Mrs. Soran, "The big boys have lots of tricks for beating Uncle Sam that us little fellows never even heard of." The same mechanism can be observed on an international scale. No country ever begins a war. The other country always begins it. Each country builds up a military machine in self-defense and shouts across the border that the other fellow is about to attack.

There are other defense mechanisms, but these three can be observed

most frequently by anyone who likes to study people. These ego defenses can be called social motives like the motives for social interaction, approval, and achievement, but reactions against things are less stable and more variable than actions toward things. Nevertheless, we can use our knowledge of defense mechanisms to influence social interaction. To make someone angry, find out what he is sensitive about and threaten him in that respect. To make social relations run smoothly, avoid comments or behavior that rub on his sore spot.

Individual Differences

Some situations are so bad that everyone is upset, but considering the general run of troubles that people get into, it is clear that some people are more easily frustrated than others. The person with good self-control, or ego control, who can tolerate frustration well seems to be the secure person who is at peace with himself and can take an intellectual, long-term approach to his problems. Children who are rated high on ego control manage to perform constructively in spite of frustration while children rated low on ego control tend to lose sight of their goals and attack the frustrating object.¹⁹

Some people are especially susceptible to environmental frustrations because they are continuously frustrated by unsolved problems within themselves. They have an uneasy adjustment to life at best, so just a little more frustration is too much. They can't take it. Some employers when interviewing an applicant for an executive job deliberately annoy him to see how much he can take before losing self-control. Certainly the ability to keep one's head in many different frustrating situations is a valuable asset to an executive, a parent, a schoolteacher, and a quarterback, though such home-made tests are too short and too specific to be useful.

If a person does react to the frustration, what does he do? One prominent difference between individuals in this respect is that some tend toward the forward or aggressive type of reaction while others prefer the withdrawing, submissive, or dependent type. Printed tests describing many situations like the following are often used to study individual differences in reaction to frustration, or these situations can be presented in picture form. What would you do?

You are walking rapidly down Elm Street to a four o'clock appointment with a friend. A man whom you know slightly is walking toward you with a Boston terrier on a leash. The dog looks familiar. It may be the dog you threw a stick at yesterday for chewing on your clothes. As you hasten past with a quick "Hello," the dog jumps on you getting mud on your sweater and scratching your arm. What do you do?

1. Say very little. Arrange to talk to the man later; then get back on your course.
2. Keep your appointment and get your friend to come back and settle the matter.
3. Remember it is half your fault. You probably started it by throwing the stick at the dog.
4. Insist on your rights. Tell the man you will throw mud on his clothes unless he buys you a new sweater.

The type of reaction to frustration depends not only on the frustrating situation but also on the habits that the individual brings to the situation. Children in many American families are encouraged to meet their problems by a compensatory or aggressive attack. "The best defense is a strong offense." In other families children are taught to accept misfortune gracefully and not let it hinder their work. When children are frustrated in the laboratory by having a movie stop at the interesting point and by having candy taken away from them, those children who have been trained in aggression react aggressively and those trained to be constructive react constructively.²⁰

Individual differences in reaction to frustration are influenced also by individual differences in other motives, such as love and power. Some children who had been rated on motivation for love and affection in social situations and also on motivation for power and dominance were given a chance to drive a toy car along a narrow road of blocks until it was blocked by the psychologist's car. It turned out that the children rated high on the power motive reacted more aggressively to this frustration than the children rated high on love and affection.¹⁵

Many of these reactions are specific to the situation, but if a person consistently makes the same reaction to frustrations we call it a personality trait, and Chapter 12 will use such traits to describe personalities. People are less consistent in their reactions than one might expect. For example, those children who show the most fantasies of aggression in stories and doll play are not necessarily the ones who show the most aggressive behavior. The techniques for identifying personality traits and using them to describe individuals must be considered seriously in later chapters.

As children grow older, their frustrations and conflicts shift. Small boys and awkward boys are often frustrated in competition with big boys and athletic boys, but this source of trouble gradually loses its importance as other motives and other conflicts become more prominent. Girls who are not glamorous often feel unhappy between 15 and 25, but appearance does not have such a high value at later ages. Girls of course do not react to frustration so aggressively as boys, presumably because of social expectations. Conflicts related to the sex drive are frequent in the 20's and 30's but less frequent in later years. Religious conflicts are more common during adolescence than during adult life. Time heals some wounds and opens others.

If a conflict is not really settled, it may be reactivated later. Parent-child

conflicts that seem to be smoothed over may recur at adolescence. A boy who gains an uneasy peace with the authority of his father may find his authority conflict reawakened when he joins the army and is frustrated by his top sergeant or when he gets a job and runs into conflict with his boss. Time does not always heal the wound; it may just put a patch over it.

In adulthood the most common conflicts are those that revolve around marriage and economic success, but adults have been frustrated much more than children so any single frustration has proportionately less effect. When older people do react to frustration, they usually prefer the more sedate types of reaction, like rationalization and verbal aggression. Naturally it is the insecure people who are most often on the defensive. Self-assured people, like the great Samuel Johnson, can take criticism without feeling threatened. After he had published his famous dictionary, when a lady asked him why he had defined "pastern" as the knee of a horse, did the learned scholar defend himself with a learned rationalization, as she expected? Indeed not. He replied: "Ignorance, Madam, pure ignorance."

SUMMARY

For scientific analysis we study motives one at a time, but the real human being in action is motivated by several dynamic factors at once, perhaps in several directions. Work is a familiar activity that is motivated indirectly, as a step toward a remote goal, or as an assignment by someone else in accordance with social expectations. Thus the long-term dynamics are complicated by such short-term dynamics as subgoals, attitude toward the work, ego involvement, task orientation, and self orientation.

As work continues, output fluctuates. If the task demands heavy muscular work by any part of the body, the movements become erratic and other bodily movements are substituted. If the task demands constant vigilance but few responses, attention becomes erratic and other activities, such as daydreaming, are substituted. The physiological cost of work can be estimated by suitable apparatus and used to compare methods of performing muscular work. The energy cost of intellectual work, however, is so small that it is hard to estimate. Job satisfaction and other attitudes toward work depend in general on the nature of the work, interpersonal relations, and the worker's satisfaction with himself. Work satisfaction is not an accurate index to work output.

Work output is reduced by inadequate environmental conditions, such as distracting lights and noises. Furthermore, during continuous repetitive work a short-term negative motivation or resistance to work often develops; it dissipates quickly during rest. In most situations the worker perceives his output and adjusts it to the social norm or to his private aspirations, com-

pensating by extra effort if necessary. These principles lead to recommendations for improving work schedules and working conditions, but under all conditions there are some individuals who turn out more work than others, because of individual differences in interest, attitude toward the job, control of attention, and self-control.

In many situations the behavior we see is not action toward a goal but a reaction to something—to dissatisfaction with work, to failure, and especially to frustration or conflict. In a superficial way conflicts may be classified as approach-avoidance, approach-approach, and avoidance-avoidance conflicts. The reaction may be sublimation or some other substitute goal activity, which may be frequently practiced and become habitual. Whatever the reaction, if the frustration is severe it is usually followed by a deterioration in quality of performance.

A common reaction to frustration is aggression. Aggression may be directed against the frustrating agent or it may be displaced onto a convenient scapegoat, such as a minority group, or against oneself. It may appear in verbal form or it may be whipped up by a demagogue into violence.

The dependency reaction is a withdrawal from life's troubles to the shelter of a protector. It has its origin in parent-child relations. Sometimes the only reaction to frustration is fantasy, a safer reaction than direct action, which can be investigated through stories, drawings, and other imaginative productions.

When the self concept is threatened, as by failure, compensation is common, even overcompensation. Or one may make light of the failure by rationalization. If one feels guilty about his actions or his motives, he may try to get rid of the guilt by projecting his motives onto someone else.

Some people are more easily frustrated than others, whatever the difficulty may be, because of lack of self-control or because of persistent personal problems. When people do react to frustration, some react by a counterattack, others prefer the submissive reaction, and others punish themselves. The type of reaction is influenced by family training and early playground experiences. The conflicts that trouble people are changing continually throughout the life span, from the storm and stress of adolescence to the quiet desperation of adulthood.

PRACTICE PROBLEMS

34. Frustration is to aggression as _____ is to projection.
35. Rationalization is to inadequacy as _____ is to inferiority.
36. Remember Aesop's fable about the fox who could not reach the grapes? Which ego defense could be called the sour-grapes mechanism?
37. When instrumental activity toward one goal is frustrated and another goal is substituted, what term from the chapters on learning may be applied? (a) Neg-

ative acceleration; (b) rote learning; (c) assimilation; (d) knowledge of results; (e) stimulus generalization.

38. Which of these concepts from the psychology of learning can be used to interpret the sublimation of motives? (a) Insight; (b) positive acceleration; (c) cognitive organization; (d) transfer of training; (e) overlearning.
39. Name two mechanisms mentioned in this book that can be called defense mechanisms but not ego-defense mechanisms.

Which of these reactions can be observed in domesticated animals, e.g., a dog? Mark each Yes or No.

- | | |
|---------------------------------------|----------------------|
| 40. _____ Aggression from frustration | 43. _____ Projection |
| 41. _____ Fantasy | 44. _____ Dependency |
| 42. _____ Rationalization | |
45. In the situation with the Boston terrier, which answer would be marked by a person who turns his aggression inward?
 46. By a person who turns his aggression outward?
 47. By a dependent person?
 48. By a person who can tolerate frustration?
 49. Does the anecdote about Samuel Johnson indicate that he rates high on ego control, or low?
 50. What kind of evidence do we need in order to identify a case of substitution? (a) Goals; (b) level of activation; (c) obstacles; (d) degree of persistence.

Discussion Questions

- A. Much of the material in this chapter is sometimes included in the chapter on abnormal psychology. Why?
- B. It has been said that children have a higher energy output than adults, but they get less done. What does this mean?
- C. If human evolution continues, will man develop more different types of reaction to conflict, or fewer?

Recommended Reading

- T. A. Ryan. *Work and effort*. Ronald, 1947. A systematic treatment of performance, physiological cost of work, motivation, and other conditions affecting efficiency of work.
- L. F. Shaffer & E. J. Shoben, Jr. *The psychology of adjustment*. Houghton Mifflin, 1956. A standard textbook that includes considerable information on adjustments to frustration and conflict.
- F. J. Shaw & R. S. Ort. *Personal adjustment in the American culture*. Harper, 1953. A college textbook emphasizing adjustment to the problems generated by the social environment.



Information Services, Michigan State University

Chapter 10. THE INDIVIDUAL IN SOCIAL ACTION

In previous chapters we have had to study relations between people in order to understand basic psychological principles of motivation, perception, learning, and thinking. In this chapter we study social activities more seriously. Man is an animal—we must never forget that—but he is a social animal, pursuing social goals in a social world. We will trace the development of the individual as he grows from a solitary infant to an adult citizen of his social world. Then we will describe communication between people, attempts to persuade people, leadership, and other patterns of social action and reaction between individuals and groups. All these activities will be clearer if we first describe some influential features of the social world in which they occur.

THE HUMAN ENVIRONMENT

Certainly the geographic features of man's environment are influential. Life beside the ocean is different from life in the mountains, and life in the tropics is different from life in the Arctic. But more and more man's environment is man-made. Today his environment includes houses, tractors, chewing gum, barbed wire, violins, and atomic radiation. Even more important for social psychology is the intellectual environment of words, ideals, beliefs, attitudes, customs, and social norms, also man-made, by which his behavior is regulated. This symbolic or cognitive environment is what we usually mean by *culture*. The child who grows up in New Guinea learns to adjust his behavior to one set of norms while the child who grows up in New England learns another set of norms, but the important psychological principle is that they all learn the norms of the adult culture. In the same way children learn to speak the language of their culture, whether it is Chinese or German. When these children become parents, teachers, police-

men, and artists, they pass on their cognitive achievements to the next generation. Thus the culture is more than the beliefs and behavior of any one individual; it is shared by many and outlasts them all.

Social behavior differs in different parts of the world partly because of geographic differences but chiefly because of cultural differences. In some Oriental cultures women have learned to feel uncomfortable out on the street unless heavily veiled; in other cultures an ounce of clothing is sufficient. Strangers are welcome among the Eskimo, but in the Dobu Islands one does not walk alone to the next village for fear of sorcery and witchcraft. But it is not only the observable actions that are different in different cultures; it is also the abstract background or system of concepts that gives them their social significance. In the same way that perception of a figure is influenced by its background, even though the background may not be emphasized, so are actions influenced by unspoken cultural assumptions about the nature of the world, about proper relations between persons, and about the goals of life. The Eskimo of St. Lawrence Island in the Bering Sea, to take one example, used to interpret the actions of the white foreigners in reference to familiar Yuit customs, but the coming of an air base and a weather station brought new jobs, new clothes, easier travel to the Alaskan mainland, regular food at the commissary, new conditions for social interaction, outboard motors, and mail twice a month, so the islanders are now beginning to identify with the mainland and to view their own actions in reference to the white man's customs.¹ People may learn and think according to the same psychological principles everywhere in the world, but they learn and think about different things in different contexts.

It is not necessary to take a world cruise to see different social environments. Within the borders of any large country, like the United States or Russia, large differences can be seen, as between life in the city and life on the farm, or between a fishing village in lower California and a mining town in Pennsylvania. The differences in verbal behavior that a tourist will hear on the streets of Georgia and the streets of Minnesota are equally striking. These regional variations in the human environment, though noticeable, are not as profound as the variations between cultures, so they are often called subcultural differences. The differences between life in France and life in Canada, or between Germany and Spain, seem important to anyone who moves from one to another, but these subcultures are all considered part of the same culture, namely, Western European culture, because Canada and Spain seem similar when contrasted with Malaya or the interior of Ecuador.

Typical behavior in any region can be observed or even photographed in order to get a description of the social environment in which people operate. Attitudes, values, and beliefs, the dimensions of the intellectual environ-

ment that give meaning to observable behavior, are investigated by psychological techniques, such as those described in Chapter 3 and others to appear in Chapter 12. Information about such preferences is often collected for scientific purposes, as to help psychologists describe the environment in which children develop, or for practical purposes, as in planning a propaganda or a marketing campaign, or for journalistic purposes, as illustrated by the public opinion polls carried in many newspapers.

Social Groups

People do not bump against each other at random, like marbles in a small boy's pocket; even in the simplest of primitive cultures people are organized in social groups of various kinds. These groups give structure to the culture because there is more interaction within groups than between groups. The first and most important group in all cultures is the family, and living in a family is just as much a part of human nature as the sex drive. It is through the family, of course, that children are introduced to the culture in which they are to live.

Another important primary group is the *peer group*. Peers are the companions and friends, about the same age, that one meets on equal terms. Among young children peer groups are temporary neighborhood groups formed by accident of age and nearness. Older children form stronger, more cohesive groups on the basis of similarity of age and interests, usually of the same sex. We must note that these peer groups are not just pieces of the adult culture; on the contrary their attraction for youth and their contribution to youth's development are due to the fact that one's peers at this age are not parents, or teachers, or policemen. We can speak of a peer-group culture, or, more specifically, of an adolescent culture, because adolescents do live at times in a world of their own, with their own language, their own clothes, their own style of dancing and other recreations, their own social norms and values.

Adults are organized in groups for purposes of recreation, politics, religion, education, occupation, community service, and what not. When Mrs. David L. Stone was asked to name the groups to which she belongs, she began:

"Well, I have been pretty busy with PTA this year since I am on the program committee. Bridge club meets every other Tuesday; I wouldn't miss that. Then I am working with a Girl Scout troop, helping the girls who are practicing for their swimming badge. I belong to the League of Women Voters, but I have missed the last two meetings. Mrs. Leavitt got me to join the Writers Club, and that takes so much of my time. And, of course, there

is the church. There is an Alumnae Club, but that only meets once a year. Then there are several things my husband and I belong to, but I call that business rather than social, and we try to come home early."

Groups vary in several respects. Some are large and some are small. Some meet daily, e.g., school and work groups, and therefore have close face-to-face relations. Others meet weekly or monthly, e.g., the Sunken Gardens Cocker Spaniel Council, and others annually, e.g., the Midwestern Psychological Association. Some groups are formally organized, with a constitution, officers, and lapel buttons, while others, like the neighborhood bridge club, operate in an informal way. Large assemblies of people are not really groups in a psychological sense because the relations between two members are not much different from the relations between a member and an outsider. Naturally, one may identify with a group, become ego involved and loyal; or one's membership may be a mere formality, of no significance to the self concept.

A large part of the world's work and play is accomplished or guided by social groups like these, and a large part of any individual's behavior takes place within such groups and is influenced by the group's norms. Large formal organizations, like labor unions and business and professional associations, influence their members through a constitution and bylaws and perhaps official publications, while small groups exert a more informal and intimate kind of approval and disapproval. The work of large associations is usually done by small committees or crews, which often become informal social groups. Since many large organizations like to have an office near the state capital, the telephone book in the capital city gives an indication of their variety. The list in one telephone book begins:

Allied Dairy Association	Builders Supply Association
Architectural Woodwork Association	Bureau for Lath and Plastering
Artificial Breeders Cooperative	C I O Council
Asphalt Paving Association	Carpenters Council
Association for Better Hearing	Chain Stores Bureau
Association for Retarded Children	Children's Aid Society
Association of Farmers Cooperatives	Christian Missionary Society
Association of Home Builders	Conference of Seventh Day Adventists
Association of Ice Cream Manufacturers	Congress of Parents and Teachers
Association of Insurance Agents	Congregational Conference
Automobile Dealers Association	Council of Churches
Automotive Wholesalers Association	County Municipal Employees Union
Bankers Association	Crime and Delinquency Council
Baptist Convention	Crippled Children Committee

Most individuals belong to several groups and in that sense the groups overlap. Thus it happens that an individual may belong to the Child Study League, which is pushing for higher salaries for schoolteachers, and the Tax

Study League, which supports a lobbyist at the capital to hold taxes down. Society is a structure of many overlapping groups, with the individuals in these groups giving complete loyalty to a few and a little support to many.

Social Status

Since cultures and groups differ in so many ways, it is difficult to compare and classify them in any sensible way, or to say that one is higher, or more desirable, or better than another. Within cultures, however, there are recognized scales of social status, running from low to high, on which people can be ranked. A person with an income of \$20,000 ranks higher than one with an income of \$2,000. A lawyer ranks higher than a grocer, and a grocer ranks higher than a porter. If we wish to predict how a person will act toward another, it is useful to know the position of each on this scale, for people interact more frequently with others of the same status, and their relations with those above them are different from their relations with those below them. The human environment is different at different regions of this scale and, since the upper regions are the most attractive, motivation is upward.

Various scales can be used to evaluate people, but they agree fairly well, so a person's general or average rank on these scales is called his *social status*. In the United States social status in general depends on income, occupation, and parentage. We shall see how these variables influence social status and in turn how status influences behavior and attitudes.

Income. The distribution of incomes in 1959 is an unbalanced distribution, as Fig. 10.1 shows. That is, more than half of the 60 million spending units

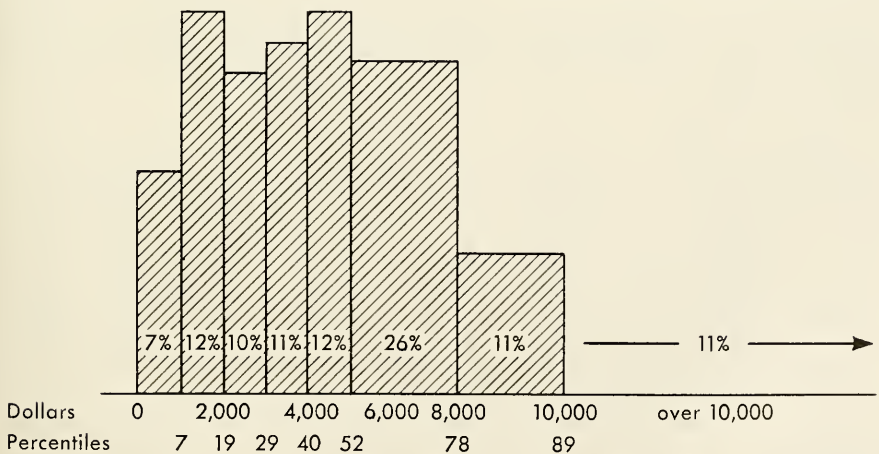


Fig. 10.1. Distribution of annual incomes of spending units in the United States in 1959. A spending unit consists of those related persons living together who pool their incomes, e.g., a family. (Data from Survey of Consumer Finances, conducted by Survey Research Center, Univer. Michigan)

in the United States had incomes below \$5000 a year, while a few were in the very high brackets. In fact the scale would have to be extended to the right several times its present length to include those fantastic incomes of movie stars, corporation executives, and financial wizards which the newspapers occasionally report to their envious middle-bracket readers.

Social status is displayed, not only in the amount of money a person has to spend, but also in the way he spends it. In general, as income rises, expenditures for nearly everything rise; it is the amount spent for luxuries, for comforts, and for "conspicuous consumption" that differentiates the high-income and low-income groups.² These luxury items are, in fact, the symbols of income status. Everyone has to buy bedding and soap, and Table

TABLE 10.1. Annual Expenditures in Dollars for Selected Items in Households of Low, Medium, and High Incomes

	Under \$2000	\$4000— 5000	Above \$10,000
Furniture	15	62	150
Floor coverings (removable)	7	25	156
Photographic equipment	1	10	30
Wine, liquor	7	16	89
Beddings, linen	10	22	34
Laundry soaps and detergents	10	17	21
Cereals	7	10	8
Ingredients (baking, cooking)	28	23	23

SOURCE: Data from *Life Study of Consumer Expenditures*,³

10.1 shows that the high-income families spend only a little more for these necessities than the low-income families. But after buying the necessities, the high-income families have enough money left so that they can spend 10 to 30 times as much as the low-income families on furniture, rugs, and cameras.³

Occupation. "Rich man, poor man, beggarman, thief; doctor, lawyer, merchant, chief." One of the first questions asked in the club car is "What's your line?" because many strangers cannot converse comfortably until they know each other's occupations. It is not polite to ask a man about his income, but his occupation is a good index to his social status, the life he leads, and his attitude on economic questions. Hence people are accustomed to judging other people in terms of their occupations and to ranking occupations on a scale of prestige. Income is a matter of facts and figures but occupational prestige is a psychosocial matter that is measured by collecting people's opinions.

To get the evidence on the prestige of occupations psychologists and sociologists have often had people rank occupations on a scale of prestige or

social status, and the results usually come out the same way regardless of when the ranking is done or who does it. The professions and business rank high, white-collar jobs and skilled jobs next, with the semiskilled and unskilled at the bottom. Dartmouth College students, for example, ranked 15 occupations in the following descending order of status: surgeon, judge, lawyer, storekeeper, postman, carpenter, tailor, miner, mill worker, and garbage man. These rankings will vary somewhat with the kind of storekeeper considered, and the kind of tailor, but the general ranking is definite, and it is approximately the same in the United States, Great Britain, New Zealand, Japan, the Union of Soviet Socialist Republics, and Germany.⁴ The status a person has, and his wife and children also, by virtue of his job, is a stable characteristic of all industrial societies.

The characteristics of a job that determine its position in the occupational scale are, according to the judgments of the Dartmouth College men, the notice it attracts, the income level, the intellectual and educational requirements, and the pleasantness and excitement of the job. Such factors as hours of work and idealism had little to do with the prestige of the job. Of course the people in these occupations are not all the same; the garbage man may own a fleet of trucks and the surgeon may be an abortionist, but these prestige rankings are general characteristics of these jobs in modern civilization. The men in these jobs assume the status that goes with them, and their children assume the status of their parents and grow up with the advantages and disadvantages such status brings them.

The income scale and the occupational scale are closely related⁵ (see Table 10.2). High incomes are associated with occupations of high prestige,

TABLE 10.2. Occupation and Income in 1958

Occupational Class	Percent	Annual Income
Professional and semiprofessional	9.0	\$7450
Managerial	4.4	7690
Self-employed businessman	7.4	6360
Clerical and sales	11.5	5010
Skilled	13.1	6000
Semiskilled	14.1	4520
Unskilled and service	10.4	2840
Farm operator	5.4	2800
Retired	14.3	1630

SOURCE: Data from *Fed. Res. Bull.*⁵

and both are associated with education. The most prominent exceptions are clergymen, some of whom have incomes below their occupational status, and professional athletes and entertainers, some of whom have incomes above

their occupational status. Income statistics for farmers do not have the same meaning as for other occupations.

Parentage. The third of the important factors that influence status in America is parentage. A descendant of a family that is immortalized on battle monuments and the pages of history books has a certain status in society by that fact alone. This factor operates more powerfully in its negative aspect, in the prejudice against members of minority-group parentage who struggle to achieve social status. Where the emphasis on parentage is extreme, as in India and in some Polynesian tribes, the social structure becomes a caste system, much more rigid than a social structure based on income and occupation. Technically the social structure in North America is a caste system with two castes, white and Negro, because the primary division is a hereditary one, and the distinction is maintained by restrictions against intermarriage. Within these two castes there are parallel scales of social status based on income and occupation. Aside from these negative considerations, the direct effect of parentage, in the old-fashioned aristocratic sense, on status in the United States is small. The principal influence of parentage is indirect and delayed, showing up in the advantages and disadvantages given the offspring in their struggles for income and occupational status.

Social Classes. There is nothing in the statistics of income to indicate where to draw a line marking off the rich from the poor. If we wish to know how some psychological variable—attitude toward labor unions, for example—is related to income, we can arbitrarily draw a line somewhere, just as we draw a line at age 18 or 21 for various legal purposes. If we wish to divide the income scale into two classes of approximately equal numbers of families, we can divide the baseline of Fig. 10.1 at \$4800. Or we can divide it into three, or four, or five intervals, but these are arbitrary divisions, like the division between medieval and modern history. The high end of the scale is very different from the low end, but the change is a continuous one, with no clear breaks between classes.

When we look at occupations, there is more reason to break up the scale into distinct divisions or social classes. A man who makes his living as an electrician's helper is clearly not a journalist, physician, manicurist, or farmer. Furthermore, a man's occupation is a public fact, available to neighbors, census takers, social scientists, finance companies, and political campaign managers. It makes sense, therefore, for many practical and scientific purposes, to divide people into broad occupational classes: professional, executive, white collar, skilled labor, unskilled labor, farm owners, farm laborers, etc. The people in the same occupational class are likely to have similar incomes and education. They have common problems to discuss and common political interests. Since social status depends closely on occupa-

tion, people tend to join social groups with others of similar occupational level. Since income and occupation are so important in these divisions, we often hear of economic classes, or socioeconomic classes.

Psychological differences between social classes appear most prominently when their attitudes and values are investigated. One big difference, of course, is that those in the upper classes, who are enjoying the best that our economy has to offer, are the most conservative about economic and political interference, while those at the bottom would like government help. This difference showed up clearly a few years ago when a nation-wide sample of a thousand men was asked: "Which one of these statements do you most agree with?"

The most important job for the government is to make certain that there are good opportunities for each person to get ahead on his own.

The most important job for the government is to guarantee every person a decent and steady job and standard of living.

The business, professional, and white-collar men picked the individualist statement (get ahead on his own) over the collectivist statement (guarantee steady job) 75 percent to 23 percent, while the corresponding percentages for the manual workers were 39 and 59.⁶ Table 10.3 gives more details.

TABLE 10.3. Occupation and Political Attitudes

Occupational Class	Individualist	Collectivist
Large business	91%	7%
Professional	77	21
Small business	76	22
White collar	68	30
Skilled manual	52	47
Semiskilled	31	67
Unskilled	33	66
Farm owners and managers	78	22
Farm tenants and laborers	55	44

SOURCE: Centers.⁶

Social classes differ also in attitudes associated with education. Well-educated people are better informed on such abstract topics as foreign affairs, tariffs, inflation, and civil liberties. They can understand, for example, the consequences of high tariffs and censorship better than people of less education. Hence social-class differences in attitudes may be due to the better education of the upper economic groups.

Since attitudes are closely related to occupations, one might ask about a person's attitude toward himself. What class does he put himself in? From the discussion of the self concept in Chapter 7 we would deduce that a per-

son's own identification with a social class would be an important influence on his behavior. When the nation-wide sample of a thousand men was asked to put themselves in one of four classes, few people considered themselves "upper class" or "lower class"—on the whole only 3 percent and 1 percent respectively. Most people called themselves "middle class" (43 percent) or "working class" (51 percent). The percentages in Table 10.4 summarize the facts.

TABLE 10.4. Occupation and Social Class Identification

Occupational Class	Upper Class	Middle Class	Working Class	Lower Class
Large business	13%	78%	7%	
Professional	4	81	10	
Small business	3	70	24	
White collar	2	61	35	1%
Skilled manual	2	26	71	1
Semiskilled	1	14	83	1
Unskilled		18	75	7
Farm owners and managers	3	42	51	1
Farm tenants and laborers	2	16	73	2

SOURCE: Centers.⁶

The clearest break in Table 10.4 appears in the middle of the table as a cleavage between the white-collar class and the manual workers. The white-collar men, composed of clerks and kindred workers, salesmen, semiprofessional workers, and technicians, tends to identify with the business and professional men as "middle class." The skilled workers, composed of barbers, cooks, carpenters, machinists, plumbers, and printers, including foremen in these trades, tend to belong to a union and to identify with the "working class." Furthermore, those manual workers who identify with the "middle class" are more conservative in their attitudes, like the business and professional men, than those manual workers who identify with the "working class." And, on the other side, those few business, professional, and white-collar men who identify with the "working class" are distinctly less conservative than those who identify with the "middle class."

In general, social classes in the United States are not clearly separated. There are enormous differences between life at the top and life at the bottom of the social scale and upward movement is not easy, but there are no rigid barriers between adjacent classes. Comparisons are based on percentages and there are exceptions to all the trends described above. Status in the small towns, for example, where everyone seems to be willing and able to rank everyone else, is different from status in the big anonymous cities. Furthermore, social structures are changing gradually all over the world. As clerical work becomes more automatized, some white-collar work-

ers may identify with the manual workers. Highly skilled manual workers may reject identification with other manual workers and establish their own unions. And, of course, those people with strong achievement motivation are constantly trying to move upward a notch or two—by acquiring more money, a job of higher occupational status, or more education than their parents had.

Some people are much more interested in the social-class structure of our society than others and spend more of their time ranking people as to social status. To such people status and achievement are the same, for no achievement is rewarding unless it brings an increase in social status and more contact with upper-class social groups. They react to a person as a member of a social class rather than as an individual. Others, who enjoy their work for its own sake and enjoy people for themselves, pay little attention to this aspect of society unless they take a course in sociology or see a play by Shaw.

Sampling Procedures

Every 10 years, according to law, a census or count is made of the inhabitants of the United States, and many facts, such as age, occupation, and education, are collected at the same time. If we wished to investigate expenditures, group memberships, or attitudes in the U.S., we could study every inhabitant also, but this would be very expensive and not really necessary. A sample of a thousand people would give us the information if we could get a sample of the same composition as the whole population. A sample that fairly represents the population is called a *representative sample*, and procedures for obtaining a representative sample are at the center of much research in the social sciences.

Suppose the language teachers of a certain university want to know how many students have tape recorders. A sample of 500 would be large enough for this purpose, so if there are 1000 students, we need to poll only half of them. If there are 15,000, we can poll $\frac{1}{30}$ of them. Obtaining a representative sample is relatively easy if the student directory contains the names of all students. We can pick every 30th name and ask this sample. If 50, or 10 percent, of the sample have tape recorders, we can infer that 10 percent of the population, or 1500, have tape recorders, and the error of this inference is about 2 percent.

Where there is no complete list of names, as when we wish to study the expenditures or attitudes of U.S. adults, the problem of obtaining a representative sample is much more difficult and errors are much larger. An accurate but expensive method maps cities, farms, and suburbs and assigns interviewers to specific dwellings in accordance with the proportion of such types of dwellings in the population. When this is properly done, the age,

occupation, education, and other characteristics of the respondents in the sample will be close to the percentages of such characteristics in the population according to the last census. Another procedure, more convenient but less accurate, sends interviewers out to question certain quotas of people in each age and economic class in order that the sample will be similar to the population in respect to the most important variables. If we wish to make comparisons between groups and get the kind of information presented in Tables 10.2 to 10.6, it is necessary of course to have representative samples of all of these groups. We can easily ask each woman in our sample if she is employed outside the home, for example, but comparisons of attitudes or child-training practices of employed and unemployed women are not convincing unless we are sure we have representative samples of each.

The principle of representative sampling is quite straightforward; the most serious error in practice is the use of an unrepresentative or biased sample, one that contains a larger percentage of a certain class of people, e.g., old people, than there are in the population about which inferences are made. The most common error is the use of a directory or telephone book as the sample. Such samples are biased in the high-income direction because fewer low-income families get their names in telephone books and lists of all kinds. This kind of bias is not serious if we are studying the buying habits of families of above-average incomes, as in planning a campaign to sell power lawn mowers. Another bias is introduced by volunteering, for we know that people who take the trouble to answer questions printed in a newspaper or to reply to a mail ballot are more interested in the question and better informed about it than the population in general. And another source of bias is the accessibility of people for interview. It would be all right if all kinds of people were equally inaccessible but actually this is not so. Employed men and women, for example, are away from home when the interviewer calls more often than unemployed men and women, so inferences about expenditures and opinions can be distorted by overrepresentation of the unemployed. All of these difficulties can be overcome by proper planning, but these are some of the biases one should watch for in reading statements about a population made from a sample of that population.

The purpose of this brief sketch of the anatomy of American society is to outline some of the main characteristics of the human environment. Anyone who wishes to understand the psychology of his fellow citizens must look at the individual within this Western European culture, see him as a member of various social groups with which he identifies and to which he surrenders a portion of his sovereignty, and sympathize with him as he tries to mount higher on the ladder of success, defining success, if possible, as he does. Later comparisons will show how the social and intellectual develop-

ment of children as well as the social interaction of adults depends on their positions in the social structure.

PRACTICE PROBLEMS

1. In which respect does the adolescent peer culture differ *least* from the U.S. adult culture? (a) Musical preferences; (b) political preferences; (c) food preferences; (d) reading preferences.
2. Suppose you were a manufacturer of a luxury product that sells only to families with incomes above \$7500. Before you buy advertising in a national magazine, you want to know the size of your potential market. Compute from Fig. 10.1 the number of spending units in the U.S. with incomes above \$7500.
3. Estimate median income from Fig. 10.1.
4. In a survey of attitudes toward trading stamps a random sample of consumers in four Michigan cities read four statements, such as: "In general, consumers benefit from the existence of trading-stamp plans."⁷ Would this statement be approved more often by the high-income people or the low-income people?
5. From the discussion of social classes, which do you believe would place a higher value on self-expression, the working class or the middle class?
6. Which would place a higher value on security?
7. Which of these novelists was most interested in status differences? (a) Hemingway; (b) Lewis; (c) Cather; (d) Wolfe.
8. What famous British playwright made his reputation satirizing class distinctions?
9. Which of these questions would be answered about the same by all social classes?
 - a. Which political party does the most for the country?
 - b. What would you say puts a person in the middle class?
 - c. Do you think that working people are treated fairly by their employers?
 - d. Do you think wages and salaries would be fairer if the government ran the factories and industries?
10. Why do social scientists classify people by occupation rather than by hair color?
 - a. Hair color of parents is not related to hair color of children.
 - b. Occupation is a more stable characteristic of the family pattern.
 - c. Social behavior is more closely related to occupation.
 - d. One hair color is not much different from another.

SOCIAL DEVELOPMENT

If we could find two little girl twins of identical heredity and separate them shortly after birth, sending one to grow up in New Guinea and the other to grow up in New England, then study them 30 years later, we would see an instructive set of similarities and differences. The two girls would be very similar in height, facial structure, skin color, eye color, hair color, amount of hair on the upper lip, and blood type. However, they would wear different clothes, do their faces and their hair in different styles, worship

different gods, worry over different problems, like different foods, become angry at different offenses, and strive for different social goals. In these social acts two girls of different heredity who happened to grow up in the same culture would be more similar than our originally identical twins.

The Socialization Principle

The development of bones, hair, and blood is due to maturation, and the final result is determined mostly by the germ cells that the individual grows *out of*. Social development is a learning process, and the final result is determined mostly by the culture that the individual grows *into*. Learning the culture is called *socialization*. It is a massive change from the simple, undifferentiated, pliable behavior of the child toward the complex, specific, stable attitudes and norms of the adult culture. Since the individuals in one culture, e.g., the United States, are so similar to each other and so different from the individuals in another culture, e.g., Alor, we often speak of social forces or social pressures that shape the individual to the culture pattern. Each individual does his own learning, to be sure, but all individuals in the culture have opportunities to learn the same attitudes, habits, norms, and values.

One of the earliest aspects of socialization is learning to enjoy social interaction, which is so fundamental that it was called a social motive in Chapter 3. When the infant learns that crying, which was a spontaneous or reflex act at first, is often followed by the appearance of the mother and can, in fact, to be used to summon the mother, a big step in social relations has been taken. And the first steps are taken quickly. Only two or three months after birth most children stop crying when they are picked up. The first social smile appears about the same time, usually in response to peekaboo games or fondling. (Don't be fooled by the pseudo smile, a sign of gas on the stomach, which is often seen in the first few weeks.)

Discriminating friend from stranger, a subtle accomplishment that requires more intellectual maturity and experience, is not usually observed until the child has enjoyed six or eight months of parental care. At this time the average child can tell a scolding voice from a playful one and a smiling face from an angry one. His social relations then take a positive turn, toward the end of the first year, when he initiates social relations, trying to attract attention by tugging on adults' clothes and banging toys on the floor. From then on, for the first few years, the child's relations with others are mostly of this simple outgoing pattern. As his behavioral versatility increases he uses a wider range of resources to get what he wants. He cries if that works. He coos if that works better. He may stretch out his arms and smile,

or he may throw a temper tantrum and refuse to eat. Whatever the original instigation for these acts, they are strengthened when they are rewarded by affection, comfort, or nourishment and weakened when these rewards are withheld.

When the child learns that some acts are punished and thus becomes sensitive to social disapproval, another powerful motive for socialization is created, powerful enough to motivate such difficult achievements as toilet training. In general the various socializing agencies, such as family and school, reinforce each other, giving approval for the same acts, e.g., being polite, and disapproval for the same acts, e.g., beating up little children. Thus in the United States there are certain social norms, like wearing clothes in public, and certain attitudes, like "cannibalism is bad" and "motherhood is good," that are so consistently reinforced that they are thoroughly learned by almost everyone and any deviation from them seems unnatural or abnormal. We have seen in Chapter 3 how emotions and motives are changed by social disapproval to conform to the norms of the adult culture.

The various socializing agencies—family, school, and peer group, etc.—supervise the learning and the definition of the achievement motive also. The young child's definition of success is immediate satisfaction of his motives. Older children define success according to a different set of values: personal appearance, athletic accomplishment, skill in dancing, school grades, and others. As these individuals near adulthood their adolescent goals are replaced by the status goals, such as income and occupational prestige, emphasized by the adult culture.

Sometime between two and three years of age the child undertakes the supreme intellectual adventure, the creation of his own ego, according to the principles of social learning outlined in Chapter 7. As he establishes his identity as a person, his achievements and frustrations mean more to him, and many children show a period of *negativism* to adult interference that usually reaches its peak between two and a half and three. His parents and older brothers and sisters, the same ones whom the child formerly saw as bearers of the sweets and the comforts of life, are now seen as barriers to self-assertion. He resists socialization temporarily.

But the child's capacity for frustration and his social skill continue to increase. Furthermore most children identify with their parents about this time. As his skill at communication increases, the child becomes more susceptible to flattery, to praise and blame, and thus more amenable to adult methods of social control. Before he knows what has happened to him, he has become well socialized. At adolescence there may be another period of negativism or rebellion against the authority of parents and teachers.

Selective Aspects of Social Development

As a general principle, it is correct to say that people learn the culture in which they live. Looking at the socialization principle more closely we can also detect minor variations because the culture is not completely uniform and because the agencies that transmit the culture are not in complete agreement about which of its aspects to emphasize. Children growing up in America become Americans, but the differences among Americans are as interesting as the similarities.

Class differences. One reason why class differences persist is that parents transmit them to their children or, to turn the principle around, children learn those norms, values, and other aspects of the culture that are emphasized by the class they live in. In addition to the differences in expenditures and attitudes between socioeconomic classes described earlier in this chapter, differences in child-training habits are particularly significant for social development, so many researchers have asked parents to tell how they bring up their children. Not that what parents say necessarily agrees with what they do, but what they say about child training does reveal something of their hopes and fears for their children. In the 1920's, for example, a survey of Middletown disclosed that business-class mothers were more up to date in stressing concentration, social-mindedness, knowledge of sex hygiene, patriotism, and independence, while working-class mothers aimed at strict obedience, loyalty to church, good manners, and good grades in school.⁸ In the 1940's a survey of Chicago mothers indicated somewhat similar class differences in child-training practices. Lower-class mothers breast-fed their children more than middle-class mothers and held them more, even when not feeding them. Middle-class parents attempted toilet training earlier than lower-class parents. Thumb-sucking and masturbation were reported much more frequently by middle-class mothers, either because the middle-class children are frustrated more and thus turn to these substitute activities or because the middle-class mothers notice these "bad habits" more anxiously than lower-class mothers.⁹ Middle-class parents trained their children to take responsibility for themselves and others earlier, to go to college and to achieve higher occupational goals, but lower-class parents expected their children to go out to work earlier. The differences between middle and lower Negro classes were about the same as between middle and lower white classes.⁹ Some of these differences are probably due to the tendency of middle-class parents to read books and follow the latest fashions in child care—which change every 10 years or so. But lower-class parents are getting up to date too in recent years, so class differences in infant feeding in the 1950's in Boston were very small.¹⁰

But even within social classes differences can be found, especially around

the big cities, where the social environment has been most affected by the large industrial concentrations of the past 50 years. In Detroit and environs it is possible to identify bureaucratic families in which the father works for wages or a salary in a large organization and hopes his specialized training will help him move up in the organization, as contrasted with entrepreneurial families in which the father is a small businessman of less education who moved to the big city to try to get ahead on his own by taking risks and beating the competition. Comparing these two types of families in Detroit, it was the entrepreneurial parents, in both middle and working classes, who were more rigid about feeding schedules, started toilet training earlier, and were stricter about self-control than their better-educated, less competitive neighbors.¹¹

Several kinds of evidence have consistently shown that upper-class and middle-class parents place a higher value on achievement, particularly educational and occupational achievement, than working-class parents. High-income families have more money to spend for education, as they have for rugs, wine, and everything else, but the amount actually spent is related also to the occupation, or source of the income.¹² Table 10.5 shows the differ-

TABLE 10.5. Annual Expenditures for Education in Medium-Income Families (\$4000–5000) in Urban U.S. According to Occupational Class

Self-employed	\$62
Salaried professional, officials	31
Clerical and sales workers	25
Skilled wage earners	25
Semiskilled wage earners	15
Unskilled wage earners	17

SOURCE: *Bur. Labor Statist.*¹²

ences in emphasis on education by occupational classes of the same income level. Although many families in all classes do not spend anything for this purpose, the average amount spent for school fees, books, and supplies is distinctly larger in the upper occupational classes. In the same way Table 10.6 shows that well-educated parents spend considerably more for the educational advancement of their children than less well-educated parents of the same income level.

Surveys of attitudes and aspirations in different classes tell the same story of greater emphasis on achievement. This reflects the willingness of middle-class families to spend more than working-class families and also the middle-class pressures and expectations. "And what are you going to be, my boy, when you grow up?" Part of this difference may be due to greater intelligence and academic aptitude in the children of middle-class families,

but there is a relation between occupational level of the parents and aspiration level of the children even when the effects of intelligence differences are removed.¹³ As a result of all these opportunities and pressures middle-class boys and girls are oriented toward future success. They think more about the future;¹⁴ they save their money, as their parents do, and postpone gratification of other drives in order to prepare for later achievement.¹⁵ This does not mean that lower-class children cannot be motivated for achievement, but rather that their achievement motivation is more dependent on promise of immediate material reward.¹⁶ The class differences in sexual behavior mentioned at the end of Chapter 3 are probably due also to the higher achievement motivation and future orientation of middle-class boys and girls.

TABLE 10.6. Annual Expenditures for Education in Medium-Income Families (\$4000–5000) in Urban U.S. According to Education of Head of Family

Over 16 years of education	\$57
13 through 16 years	37
9 through 12 years	23
8 years and under	20

SOURCE: *Bur. Labor Statist.*¹²

Education. All cultures have educational institutions of some kind for transmitting adult knowledge, skills, customs, values, and attitudes to the young, for “bringing them up right,” and thus assuring the continuity of the culture. In literate cultures like ours, where so much of the culture is embodied in words and other symbols, educational development, as in learning to read, is a major aspect of socialization. The 10 to 15 years spent in educational institutions is bound to have an effect on attitudes and values as well as knowledge and skills. The public schools teach the publicly approved social norms of the culture, as interpreted by teachers and administrators, who are more familiar with middle-class norms than with the low or very high ends of the scale.

After age 16 or so, when education is no longer compulsory, the influence of education is more specialized. Those who go on to college acquire more of the abstract knowledge and values of the culture. But it is not only the amount but the kind of education that influences social development. Many comparisons of college students have demonstrated that students in business colleges place a high value on economic and political success, that students of literature and the arts have high aesthetic values, and that those who study social sciences acquire an interest in foreign affairs and social problems. Some comparisons of values are given at the end of Chapter 3.

We must be careful, however, not to take college too seriously. It is true

that college graduates make more money than high school graduates and have more knowledge, more sophisticated values, and higher social status, but education is a symptom of social development as well as a cause. Those who go to college have higher social status to begin with, more intelligence, more interest in intellectual things, and higher achievement motivation than those who stop at high school. And the differences between graduates of one college and those of another are due as much to the kinds of students the two colleges attract as to the kinds of education they receive. Students of upper-class status frequently go to an expensive private college with other students of similar status and family background. Students with strong religious values are more likely to go to a church-related college. Those with strong scientific interests may pick a college that has graduated distinguished scientists, and those with literary interests may pick a college that can boast of literary alumni. In a large university students are attracted to different departments or courses of study for similar reasons. Education reinforces existing differences in status, ability, and interests at the same time that it offers ambitious youth a chance to improve all these.

We must be careful, also, not to think of education as merely passing on the culture. Education creates culture whenever professors and students discover new facts, invent new principles, or interpret the old facts in a new way. Throughout history, while educational institutions have been transmitting the old culture to the young and stabilizing society, they have also been manufacturing new culture and upsetting the society that supports them. Thus a college student may be learning a radical method of merchandising or a new social philosophy or a creative approach to architecture at the same time that he is learning the great traditions of the past.

Peer Groups. The influence of the peer group on the social development of the individual is closely related to age. Very young children do not interact with their peers to any extent, even though they may play side by side. Around age three or four children begin to play *with* each other and from then on children's groups increase in size and influence. Young children playing with each other learn simple social skills, like taking turns and sharing toys. Older girls and boys learn motor skills, like skipping rope and playing ball, as well as social skills, like making friends, making excuses, telling jokes, and planning social activities.

In order to enjoy the delights of peer-group activity children have to conform to peer-group norms. The disapproval which the 5-year-old fears is his parents' disapproval, but the 10-year-old fears his friends' disapproval also, and the teen-ager may fear the disapproval of peers more than of parents. Some children who do not learn to control their emotions at home do learn this social skill at play when they find that their peers' disapproval is more brutal than their parents'. Peer-group controls on social behavior are usually

exercised informally, in the corridors, on the playground, and on the dance floor, but some groups are formally organized in clubs and gangs with definite rules and rigid enforcement. These peer-group controls are stronger, of course, in respect to things of special interest to the peer group, such as clothes, slang, secret languages, dancing, singing, dating, and friendships, than in respect to the affairs of adult life, such as occupational expectations.

Other Selective Influences. There are other influences, probably of less importance, that slant social development one way or another. Children who grow up in a minority group, for example, may not learn the culture of the majority exactly as their neighbors do, both because their parents may wish them to retain identification with the minority group—and may even send them to special schools to learn the language, customs, and loyalties of the minority group—and because the majority group may refuse to admit them to complete membership. Religious groups and youth organizations established by adults may have a strong influence on some youths. From current novels and plays it appears that military experience influences social development one way or another. And the picture of our culture would not be complete without mention of the thousands of organizations, often called *pressure groups*, that try to influence the interests, attitudes, values, and buying habits of boys and girls. The well-financed pressure groups with long-term programs naturally establish an “educational” department and aim their propaganda at the coming generation. Some of these groups operate by distributing free literature, exhibits, or movies to the schools and by trying to get teachers and textbook writers to push their point of view, or at least to “protect” the children from some other pressure group. Some offer prizes for essays that present the donor’s position or product in a favorable light.

Thus by face-to-face contact in primary groups and by the miracles of modern communication children are introduced to the culture as a whole and to those aspects of the culture which are of special concern to special groups.

Conformity and Independence

The shaping of human protoplasm into the pattern of the culture, which we call socialization, has far-reaching consequences for the prediction and control of human conduct. The behavior of any individual is the result of the manifold characteristics of the individual multiplied by the assortment of social forces that civilized life focuses on him. In any social situation, therefore, one might expect that the behavior of a hundred people would be as variable as the behavior of a hundred leaves on a windy day. But that is not what happens. If, in meeting an acquaintance on the street, you smile

and say "Hello," the response you will get 99 times out of 100 will be the conventional one. The range of variation will be very small because the social norms your acquaintance has acquired reinforce certain modes of greeting and prohibit others. Regardless of the chemistry of his blood, the urgency of his mission, or the charm of his companion, your acquaintance will usually give the customary response.

So human behavior is not altogether capricious. In social relations the rule is conformity, not variation. Restaurateurs can predict the peaks in their business quite well. Clergymen know on what days at what hours people will come to worship. Even the animals in the zoo seem to know when visitors will arrive and throw peanuts to them. One is likely to overestimate the capriciousness of human behavior for the same reason that one who is waiting for a bus going north is likely to overestimate the number of buses going south.

By conformity we mean, of course, conformity to a social norm. Everybody eats, but eating is not conformity; it is a biological drive. Eating at certain times in certain ways rather than others is conformity to a social norm. Chapter 3 described how children learn to seek social approval in general, and the present chapter has described how they are exposed to the norms of various groups. To show how all the principles work together, let us consider a simple and familiar act: going to a nine-o'clock class. Our culture, unlike some others, places a high value on punctuality. Clocks are located all over, and children learn to tell time early in life. When they go to school, they soon learn that tardiness is disapproved, and they master techniques of adjusting to this social norm. Any particular student, then, on any particular morning starts for his nine-o'clock class knowing the norm and motivated to conform to it. But anything can happen, and he still could be early or late. Here is where the feedback principle operates to reduce the variation. If he looks at his watch and sees that he is behind schedule, he hurries. If he seems to be ahead of schedule, he slows down and chats with friends. Thus records of arrival at class show a sharp peak at the social norm¹⁷ (see Fig. 10.2). Knowledge of the norm, motivation to conform to it, and information about deviation from the norm reduce the range of variation and take the capriciousness out of human behavior.

As the social pressure to conform increases in strength, more people conform and fewer deviate. The evidence for this principle comes from observations of motorists at traffic intersections. Motorists in Syracuse, New York, were classified, according to their speed in driving past a corner, into four categories: full stop, slowing down to a very slow speed, slowing slightly, going ahead at the same speed. To get a picture of the variations in behavior when there is no particular pressure to conform, motorists were observed at an ordinary corner where there were no signs and no restric-

tions other than the driver's good sense, a quality that fluctuates greatly. Fig. 10.3 A shows what happens in this situation. Behavior is spread out from "Full stop" to "Same speed" with most people in the middle and about the same number at each extreme.¹⁸ Fig. 10.3 B shows what happens when social pressure, in the form of a stop sign, enters the picture. The number who stop increases from 17 percent to 76 percent. When there are both a stop sign and a traffic officer, the number who conform increases to 94 percent, as one can see in C. In this case the social norm is established by an official agency of society, the police, and symbols of this agency, the stop sign and the traffic officer, push behavior toward the norm. The more an act deviates from the norm, the less frequently it occurs.

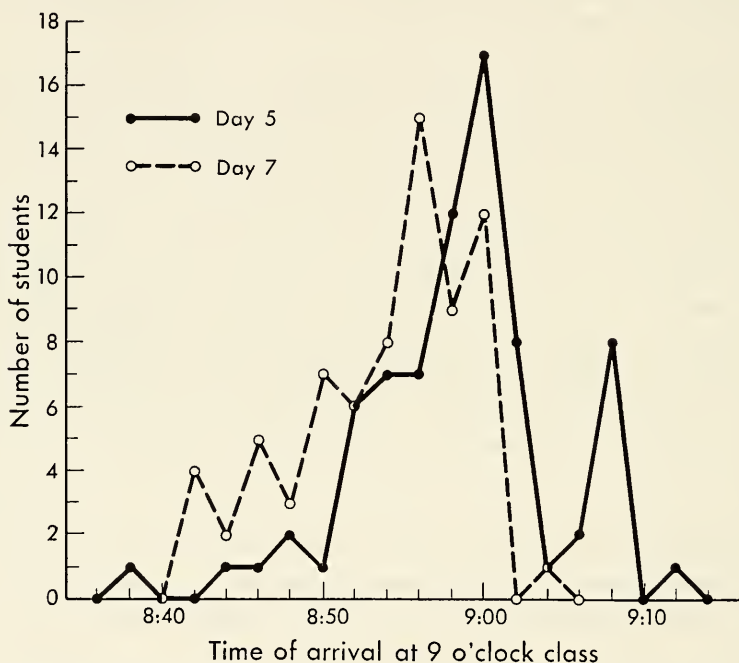


Fig. 10.2. Conformity at 9:00 A.M. Two curves showing time of arrival at a psychology class at Columbia College on two different days. (Data from Chin¹⁷)

Traffic norms apply to all drivers, but special groups, such as peer groups, boys' clubs, religious groups, and professional associations, often establish their own special norms and restrict their members from deviating from them. If the pressure is strong, the instances that conform will be piled up at or near the official position, while the number who stray from the fold will be fewer the farther they stray¹⁹ (see Fig. 10.4).

It is possible also to bring people together as a temporary group and watch the formation of group norms and the development of pressure to conform

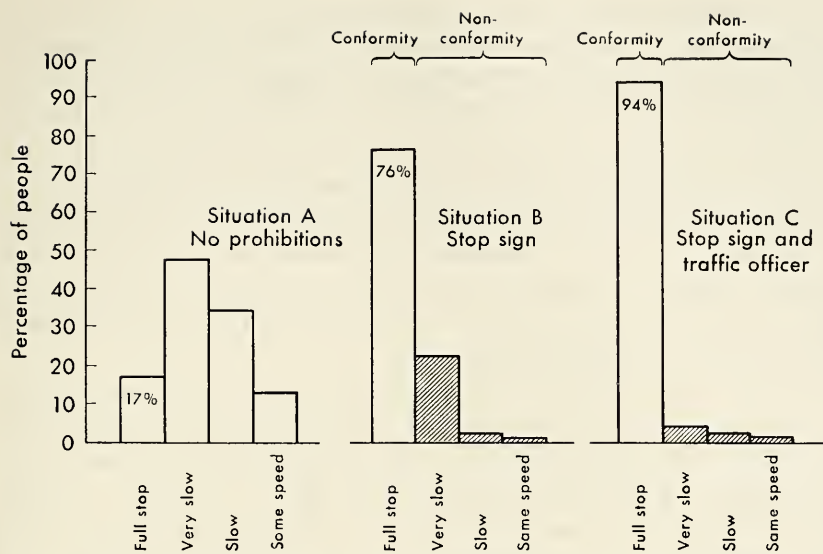


Fig. 10.3. Conformity at the street corner. Four types of behavior were observed: conformity and three degrees of nonconformity. As the social pressure increased, conformity increased. (Data from Allport¹⁸)

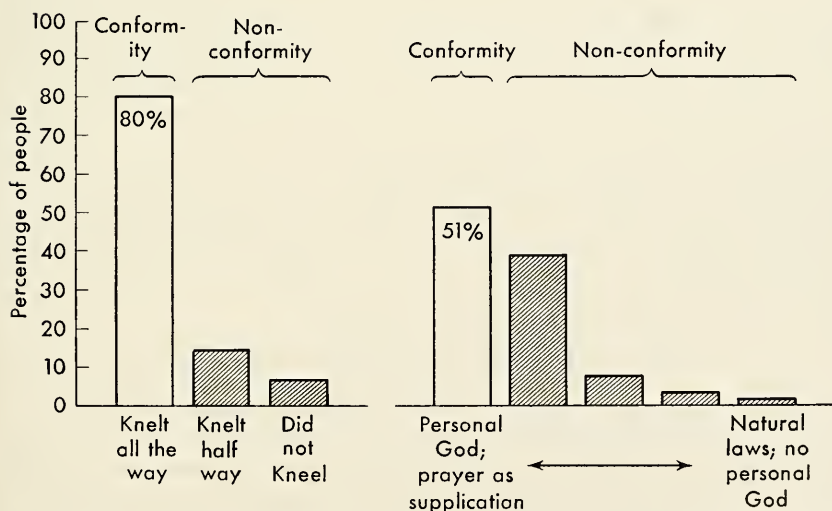


Fig. 10.4. Conformity in religious practices and beliefs. About 80 percent of the people observed in two Catholic churches conformed by kneeling all the way, while the others showed different degrees of nonconformity. About 51 percent of the Catholic students at Syracuse University conformed to the official Catholic beliefs in God and prayer, while the others showed different degrees of nonconformity. In each case extreme nonconformity was less frequent than partial nonconformity. (Data from Allport¹⁹)

to them. Many experiments have been arranged in which a small number of people are asked to locate a tiny light in the dark, estimate the length of a line, guess the population of San Diego, or express their opinions on controversial issues. Nearly always there is considerable variation at first; then, as different people announce their judgments and discuss them, the variation decreases and the judgments cluster around the average of the group. Naturally the trend toward conformity is greater when the objective facts are not clear cut and when the individual has not previously formed definite opinions. The conformity is greater also when the group is one that the individual admires and wishes to be identified with than when it is an artificial group of no significance to him.

Considering all the pressures for conformity, by the culture in general and by influential social groups, it is no surprise that most people conform most of the time. Even "bad boys" and professional criminals obey more rules than they break. But in all the investigations of conformity deviations from the norms have been observed, even with a stop sign and a traffic officer. And the history books tell us that in critical situations there have always been a few dissenters. In the laboratory experiments it is possible to measure the degree of conformity, with more precision, in terms of amount of movement toward the group norm. In fact a false group norm, quite different from the obvious facts, can be introduced, and in such experiments a wide range of conformity has been observed, from agreement with the unrealistic norm to stubborn independence.²⁰ Most people, of course, make their judgments between these extremes, somewhat influenced but not completely taken in. Many people yield slightly to the influence of a group norm even when they are told that this norm is false.²¹ Furthermore, there is considerable generality of individual differences in susceptibility to group pressure in these laboratory situations. Those who yield to the group most on estimating lengths of line yield most on judgment of matters of fact and matters of opinion. Hence, after describing the pressures for conformity, we must consider individual differences in amount of conformity. Why does not everyone conform all the time? Where does the nonconformity come from?

To begin with, the pressures for conformity do not operate on everyone with the same force at the same time in the same direction. In all families children learn to fear social disapproval, but in some families the disapproval is not serious. Some boys and girls have such strong biological drives or social motives that these motives overcome social disapproval. If a boy really likes to play the violin, he plays it, whether the other boys approve or not. Furthermore, different socializing agencies, as noted earlier in this chapter, establish different norms, so the conformity pressures are not all in the same direction. The Sunday school norms may contradict the peer-group norms.

The girl who, in one group, appears to be an independent nonconformist may be conforming to the norms of another group with which she is more strongly identified. If anyone, for any of these reasons, exerts his independence a few times and notes that nothing terrible happens, his fear of social disapproval is weakened.

At the abstract level, above all these overlapping conformities, is the fact that Western European culture, and many other cultures, places a high value on independence alongside the high value on conformity. Children in school are taught to be good boys and girls and come in from recess on time, but they are also told about men and women who became great by being different. They read in history books and biographies about dissenters who were beheaded and about others who were immortalized in song and story. There is an emphasis on individuality and self-expression in literature, art, dancing, and decorating the high school gymnasium for the Halloween party. The degree of conformity in any social situation, therefore, is a result of many interacting personal and social variables, and, while most people conform to the norm, especially if there is no good reason not to, there are always a few independent characters who deviate more or less in their own individual fashions.

The pressure for conformity does stifle the production of new ideas, and a willingness to do something different is a common ingredient of intellectual accomplishment. There is experimental evidence that nonconformists solve more difficult problems in the psychology laboratory than conformists of the same general intelligence.²² In college those who get high scores for conformity get lower grades than the nonconformists. Distinguished artists and scientists are independent thinkers because they win their distinctions by breaking rules, assumptions, or established habits of thought. Outside their special fields of accomplishment most of them are conventional people, who wear ordinary clothes, pay their taxes, eat ordinary food, and stop at stop signs.

PRACTICE PROBLEMS

11. From Fig. 10.2 guess which was the mid-term day.
12. From reports of social anthropologists it is possible to compare cultures all over the world in respect to child training, e.g., in punishment for aggression, and also in respect to fantasy, e.g., favorite folk tales.²³ From the principles of the preceding chapter would you predict that cultures which punish children severely for aggression would have folk tales involving more intense aggression, e.g., killing and maiming, than cultures which tolerate childish aggression?
13. Considering the folk tales of all cultures, will friends be the objects of aggression more than strangers?
14. Will those cultures that tolerate aggression in their children have more folk tales in which a friend is the object of aggression than those cultures that punish aggression severely?

15. In one experiment college women were tested for conformity to the group in judging lines and were also given a printed test of many items such as the following.²⁴ Which alternative would be marked by the high conformers?

He has been in poor health for some time, but, despite this, he is engaging in strenuous physical activity because:

- He fears his health might get even worse if he should take it easier.
- This relieves some of his tensions and lets him sleep better.
- He has always believed in keeping one's body strong.
- He hopes that others will admire him for trying.

The table at the right shows the number of pedestrians who conformed and the number who violated at a crosswalk in Austin, Texas, on three afternoons when a traffic signal said WAIT. The observations were made as a model, a man of 31, walked across the road against the signal. In one condition "the experimenter's model was dressed in clothing intended to typify a high status person, with a freshly pressed suit, shined shoes, white shirt, tie and straw hat." In the other condition "well-worn scuffed shoes, soiled patched trousers and an unpressed blue denim shirt served to define the model as a low status person."²⁵

	X	Y
Model A	250	40
Model B	276	12
Control	742	8

- Which column of the table represents conformity, X or Y?
- Which is the high-status model, A or B?
- The famous Kinsey studies of sexual behavior, mentioned briefly at the end of Chapter 2, attempted to get representative samples of U.S. men and women to volunteer for interviews. From what you know about conformity, would it be harder to get a representative sample of men or of women?
- Would you expect lower-class women to volunteer more frequently than educated women?

PATTERNS OF SOCIAL INTERACTION

People interact with other people in many ways. They talk and they listen. They judge each other. They buy and sell, compete and cooperate, lead and follow. They play games and serve on committees. In order to understand this fascinating flow of social activity we must observe the acts and analyze them more precisely, and for this purpose the principles of motivation, perception, learning, and judgment, developed in preceding chapters, will be helpful. Information about status, attitudes, socialization, and conformity presented earlier in this chapter will also be helpful. If social groups and social classes are the anatomy of a culture, social processes are its physiology. Obviously the most basic of these processes is communication.

Communication

One scheme for analyzing social interaction is to treat a person as a stimulus. This is a special kind of S, to be sure; an S that responds. And the R a person

makes is a special kind of R, and R that acts as an S to another person. This reciprocal or interpersonal relation is the essence of social behavior; one adjusts his behavior to the behavior of another. When Mr. Dodd saw Mr. Stone walking to work, Stone could be considered an S, to which Dodd responded: "Good morning." This R was an S for Stone, to which he in turn responded: "How are you?" In the third act of our little sidewalk drama Dodd replied to Stone: "Just fine." (See Fig. 10.5.)

Stone: S
Dodd: R = "Good morning" = S → R = "How are you?" = S → R = "Just fine"

Fig. 10.5. Sidewalk interaction.

At this point our useful concepts S and R lose their usefulness. Since the communicative R of Mr. Dodd is a communicative S to Mr. Stone, we can speak of it simply as a communication, or a message. We shall find it useful also to speak of the receiver of a communication and the sender, or communicator. As the chapter on perception told us, the effect of a stimulus, or message, is greatly influenced by the background within which it is perceived, and when anyone sends a message, he adjusts it to this social context. At least three aspects of the context of a communication are influential: (1) First is the social situation in which it occurs. Communication on the sidewalk is different from communication at the office, or in a court of law, or between embassies. And at the Christmas office party communications are sent and received within a very different frame of reference. (2) Second is relative social status. The "Good morning" the supervisor gives the general manager is different from the one he gives the new typist, and the supervisor in turn is differentially influenced by a "Good morning" from these two positions on the scale of status. In general a communication from above receives more attention and is more likely to be followed by action than a communication from below. (3) Third is previous social relations. If the sender and the receiver know each other's habits of communication, the message falls on an intricate background of interpersonal contacts. A wave of the hand or an "I'll take the other one" will have different consequences when embedded in different contexts of past relationships.

Within these various situations the communication itself takes many forms, such as gestures, spoken words, and written words, and if the social context is definite, one form of communication is as good as another. In the walking-to-work situation, for example, almost any act, a smile, a nod, a "Hyuh," or a grunt, will be perceived as a conventional greeting. In other situations, on the contrary, as when one enters a hotel room and immediately gets a phone call or when a sentry challenges a stranger, the context is not sufficient and the communication itself is much more important.

When the communication is important, there are no stimuli as useful as words, with their ease of production and perception and their flexibility

of combination. Their usefulness depends, of course, on standardization or conformity to social norms, called standard usage in this case, and recorded in dictionaries and grammars. Words, like money, are a good medium of exchange just to the extent that they are uniformly offered and accepted in the trade of ideas. But new words, symbols, and gestures, and new uses for old ones, are continually being invented and, if used by enough people, become the social norms of tomorrow. Thus at any moment there are social pressures for variation in the meaning of a word and opposing pressures for conformity. Fig. 7.20 shows the amount of conformity in respect to the favorable-unfavorable dimension in usage of three common words. These graphs are to be compared with Figs. 10.3 and 10.4, which illustrate amount of conformity in behavior and attitudes.

Persuasion: The Effectiveness of Communication

In many situations of civilized life, where physical force is seldom used, the motivation of the communicator is to persuade another person to do something or to believe something. This is the chief occupation of pressure groups and a minor occupation of many other groups. Even in uncivilized conflicts between nations persuasive or psychological warfare always accompanies military force. We can draw a rough distinction between persuading, selling, or propagandizing at one extreme and informing or educating at the other extreme, although intermediate examples are not hard to find, and many propaganda agencies call themselves information or educational services.

The net effect of persuasion is the resultant of two tendencies: the forcefulness and clarity of the communication, working in a positive direction, and the critical examination or self-control of the receiver, working in a negative direction. If the receiver were completely uncritical, he would accept any communication he could understand, without examination. This extreme suggestibility is rare. If, on the contrary, the receiver were not sensitive to communication from others, he would go through life alone, every act and opinion a solitary enterprise. This too is rare. The effects of most communications fall somewhere between the extremes of complete acceptance and complete rejection.

Persuasion is intended, either directly or indirectly, to move people to action: to buy something, to vote for someone, to take polio shots, to give blood, to drive safely, to join a union, not to join a union, and so on. The persuasion may attempt also to change attitudes, opinions, or beliefs, that is, to win favor for a company or a program or an individual, in the hope that this will influence action at a later date. We have seen that attitudes and habits of action are acquired during ordinary socialization, influenced largely by the family and by conformity to the norms of various social groups. When we

test the effectiveness of deliberate attempts to persuade, our dependent variables are actions and attitudes, measured by procedures described in Chapter 3, and our independent variables are variables associated with the communicator, the receiver, the communication, and the medium of communication.

The Communicator. The communicator with prestige is, as a rule, the most influential. The experiments that prove this principle are done in the following way. A persuasive communication, such as argument for control of monopolies, is delivered to an audience, and they are systematically asked whether they agree with it, or perhaps their attitudes on control of monopolies are measured before and after the speech. One half of the audience is told that the communication comes from a high-prestige source, such as a successful businessman or economist for the General Steel Company. The other half of the audience gets the same communication attributed to a communicator whose name is unfamiliar. The experiments show, when average effects are computed, that the communicator with prestige has more influence than the unknown. Advertisers make use of this principle when they hire athletes, actresses, and other big names to endorse their products.

This kind of persuasion is not always effective, probably because some listeners are suspicious of the competence or the sincerity of the supposed expert. Other experiments have shown that the communicator who is considered trustworthy has more influence. But these critical tendencies are rather unstable; in some cases the listeners are suspicious of the communicator at first and therefore reject his message, only to accept it later when their suspicions have relaxed.²⁶

Receivers. When we turn to the people at whom the communication is aimed, we find that the effect of the communication is clearly dependent on intelligence and information. Intelligent well-informed people can grasp and recall a larger proportion of the message than others, particularly if the message is abstract. But intelligent well-educated people are also more critical, less suggestible; they have the intellectual skill to detect logical flaws in the communication and the resources of information against which new arguments can be checked. Thus it is the poorly educated who are most often taken in by trick merchandising schemes and who are most susceptible to panic when the radio announces an attack from Mars²⁷ or when a newspaper prints wild stories of a "phantom anesthetist."²⁸

Certainly the receiver's motivation toward a communication is important, but motivational variables are hard to untangle. We know that one person may hear a sports broadcast and grasp 90 percent of it while an equally intelligent listener may not even remember who pitched. Communications about bridge, clothes, and politics likewise may fall on eager or reluctant ears. Furthermore, motivation can be negative as well as positive. When a

series of cartoons was used to ridicule prejudice against minority groups, it appeared from the results that a large percentage of the prejudiced readers simply missed the point.²⁹ We must not forget, however, that an intense interest can overcome negative motivation. A professional Democratic politician listening to a Republican broadcast will not miss the points with which he disagrees; he will probably remember more of these than the neutral listener because he is planning a rebuttal.

But the person's motivation may cancel the effects of communication before it begins. By and large, people seek communications that fit in with their own attitudes and interests and avoid people and arguments on the opposing side. Protestants hear Protestant sermons and Catholics hear Catholic sermons. Liberals read liberal newspapers and conservatives read conservative newspapers. High hopes of mass education via the air waves have been tempered by the discovery that people who listen to good music on radio and television are not musical illiterates waiting to be educated; most of them are people of good taste who select what is free just as they select concerts for which they pay.

Since motivation is frequently related to group membership, it is not surprising that the receiver's identification with a social group can raise or lower the effectiveness of a communication from outside the group. When an outside speaker appeared before several Boy Scout troops and tried to shift their interest in tying knots and woodcraft to interest in local problems, it was the boys who valued their group membership most highly who shifted the least.³⁰ Intelligence and education may be individual variables, but motivation to accept or reject a communication is often embedded in the social situation. Even the prestige of the communicator is an interaction involving the communicator, the listener, and the social situation.

The Communication. Ideas are weapons in social struggle. The course of history has been changed by books like the Bible and *Das Kapital* and by speeches like those of Robespierre, Patrick Henry, and Mahatma Gandhi. It is very difficult, of course, to untangle the effects of these historic messages from the organizational efforts and the events that accompanied them; hence research on the effects of communications has usually dealt with the modest contributions of ordinary writers which can be put on film, tape, or paper and manipulated experimentally.

Such research has shown that it is relatively easy to persuade people temporarily on a few specific points: Mr. Hitler was a bad man; Korean children are charming; Krispie Krunchies are sugar-coated. It is much harder to demonstrate a lasting influence on abstract attitudes, values, or actual behavior. The appeals used in the message, some of which are evaluated in Chapter 3, must be adjusted to the audience. The pitch cannot be made too strong, for example, or the audience becomes suspicious. In general, edu-

cated people are more susceptible to the low-key conversational style and to the logical or apparently logical message. The less well educated, since they are less critical, are more susceptible to the "hard sell." One way to immunize people against subsequent propaganda is to present both sides of the argument in advance of the persuasive message.

In general, one is likely to remember information and arguments that will be useful in one's own activities, including expected activities and the defensive activities described in the preceding chapter. In 1941, when Communism was a hot topic on some college campuses, it was demonstrated that students sympathetic to Communism learned and retained more of a pro-Soviet argument than those who were opposed to Communism³¹ (see Fig. 10.6). But there are many kinds of arguments. Recent research has shown that people in favor of segregated education are more likely to remember pro-segregation arguments that are plausible, e.g., "Southerners will have to pay the price of lowered scholastic standards if they yield to the pressures to integrate their schools," than those that are implausible, e.g., "If Negroes and whites were meant to live together, they never would have been separated at the beginning of history." And they are more likely to remember anti-segregation arguments that are implausible than those that are plausible.³²

The communications that are most effective are communications about events, or, to say the same thing in another way, events are the best propaganda. When attitudes are sampled repeatedly, as by a public opinion poll, the changes resulting from speeches, advertisements, and other persuasive attempts seem rather small compared to the changes that follow events, such as a rise in prices, unemployment, a declaration of war, or the announcement of Sputnik. The congressman who can influence employment possibilities or the price of corn in his district, or get credit for doing so, has as good a propaganda weapon as the silver-tongued orator. Taking the American automobile as a case in point, the development of the American buyer's taste was due as much to the cars the manufacturers put on the road as to the advertisements they put in the magazines. And, likewise, the recent change in the public's attitude has been due not so much to a change in the advertising message as to the appearance of small cars on the roads. For a thorough understanding of changes in attitudes we must consider events as well as propaganda and, of course, the media by which these are communicated.

The Medium. One of the advantages of a complex mechanical civilization is the abundance and variety of media or channels of communication. In addition to old-fashioned face-to-face conversation and speeches, we have books, magazines, daily newspapers, movies, slides, disk and tape recordings, television, radio, leaflets, and skywriting. Each of these has its own

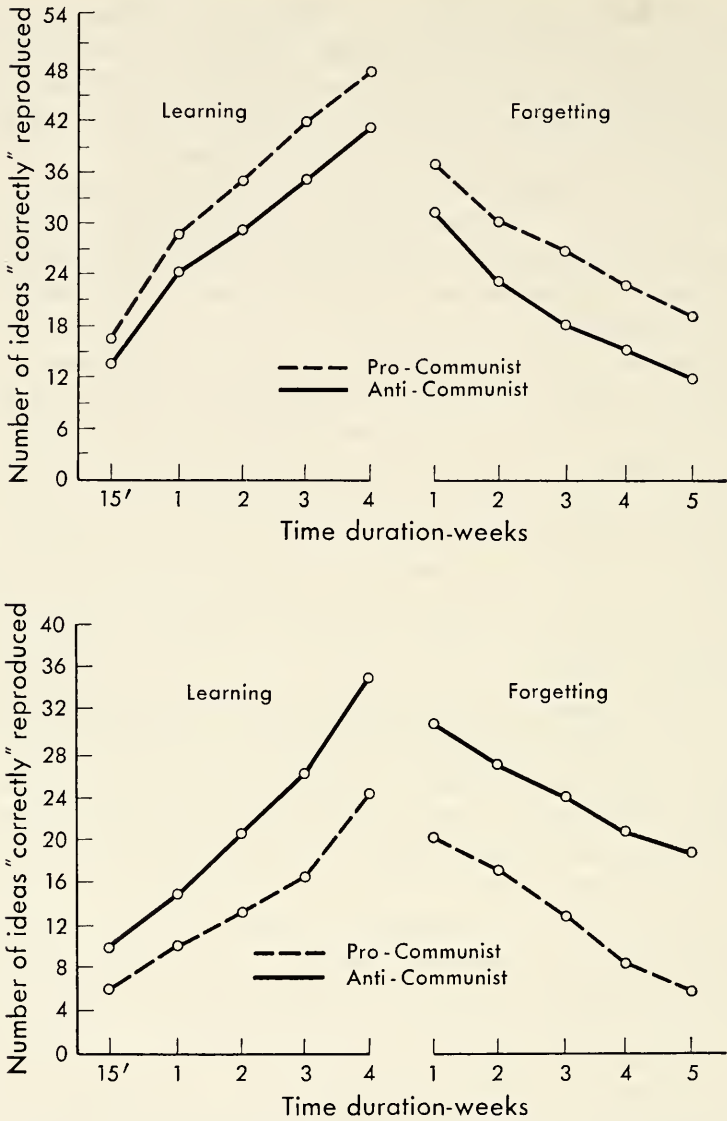


Fig. 10.6. Learning and forgetting of controversial material. The top curves show how pro-Communist and anti-Communist subjects learned and forgot a few paragraphs favorable to the Soviet Union. The bottom graph shows that the curves are reversed when the same comparison is made with anti-Soviet material. (From Levine & Murphy³¹)

combination of advantages and disadvantages, which research is now beginning to analyze. The most flexible, to be sure, is person-to-person conversation, because the talker can adjust his message to the intelligence, education, and interests of his listener and can shorten, lengthen, or edit the message according to the social feedback, that is, the facial expressions

and comments of the listener. Furthermore, the personal contact itself seems to bring to a focus on the receiver whatever personal influence the communicator may have. It is probably for these reasons that several researches on vote-getting and money-raising campaigns have emphasized the effectiveness of the personal approach.

When the listeners are gathered in a room and the communicator delivers a speech or lecture, he reaches more listeners per hour, but he loses most of the advantage of adjustment to the feedback. However, if the audience is homogeneous, he can still pitch his message at the proper level of education and interest.

The mass media, such as television, radio, newspapers, and magazines of large circulation, have the advantage of reaching large numbers of people, but they have the disadvantage, in proportion to their size, that their audience is so varied they must communicate at a rather low intellectual level to be sure of reaching them all. But there is great variety even in this respect. Some magazines and newspapers of large circulation are like department stores, with something for everyone. Radio and television are similar. And everyone listens to what he likes. Hence the influence of the mass media may be overestimated. A little magazine published by a small group with which the reader feels a strong identification may have a much greater influence per reader.

A combination of media found to be effective by fund-raising agencies is preparation by the mass media followed by personal solicitation.

There are obvious intrinsic advantages for different media of communication. The visual media—charts, movies, television, and the blackboard—are particularly useful for communicating spatial and mechanical arrangements, geographical relationships, and the like. Animation techniques make it possible to describe things that would be difficult to describe verbally. Auditory media have an intrinsic advantage in communication of music, poetry, foreign languages, and so on. The written word seems to have the superiority in communicating abstract material to those who are interested and competent.

An apparent advantage of printed media, that is, books, magazines, newspapers, maps, and charts, is that their use is controlled by the reader. He can read them when he wishes, turn the pages as he likes, skip what he already knows, and reread as necessary. Contrast this with the lecture, radio, television, and movie, which proceed at fixed rates. This is not an intrinsic difference, however. Phonograph records and tape recordings are often filed in libraries where they may be taken out for study at the listener's control, played and replayed as necessary. It is not impossible that the same arrangement will be made feasible for movies, so that the student can see what he wishes to see, three or four times if necessary, and skip what he

already knows. But we must not jump to the conclusion that all receivers and communicators take full advantage of the potentialities of the medium they are using.

The media differ also, like communicators, in the prestige or status that they enjoy. Television, for example, is a latecomer that does not yet command as much respect from educated people as a book or magazine, especially one without pictures. More important, readers build up a general impression of a particular magazine or newspaper and evaluate what they read within this frame of reference. No one is startled when a newspaper argues for a free press or a medical journal attacks "socialized medicine." Most readers take account of these tendencies and are more impressed when a Democratic paper supports a plank in the Republican platform or a manufacturers' journal attacks monopolies.

Recalling earlier discussions of interference in learning and thinking, one may infer that any single medium will be maximally effective when it has the field to itself. As a familiar example, in most United States cities there is only one newspaper. Now if all one knows about the plans for a municipal swimming pool is what appears in a single newspaper, that paper has maximal effectiveness in this respect. But if the local radio happens to broadcast a different account of the plans and personal friends carry a still different story, the effectiveness of each single medium is diluted. United States history shows that many presidents have been elected in spite of overwhelming opposition of newspaper ownership, and the reason is that a presidential election is a national event that is widely and variously discussed via all media. No single channel of communication has a monopoly. When there is only one mass medium of communication in the community or when an individual exposes himself to only one, the power of that one can be considerable. The person who makes use of several different sources of information has the best chance of forming reasonable opinions.

From these principles it follows that one who controls all the channels of communication can in time persuade the public to believe almost anything. And, in reverse, they explain why uncontrolled communication is so important for democratic government, which is founded on diversity of opinion. Maximal control of communication, both formal and informal, can be established in a prisoner-of-war camp, and this in fact is the chief technique of what is picturesquely and inaccurately called "brainwashing." Interviews with returned prisoners disclosed that mail from home was manipulated so that only bad news was delivered, military news of the prisoners' units was held back so the men thought they had been abandoned, and groups and group loyalties were broken up by forced movements and by competition for food. Any statement or move that looked like collabora-

tion was rewarded by promises of food and improved status. Interrogators or "instructors" sometimes lived with the prisoners to "teach" them about peace. Some prisoners made errors of judgment or strategy due perhaps to illness and malnutrition, but what success the Chinese captors had in obtaining confessions and collaboration was due mainly to their total control of the social environment, not, as some have claimed, to Pavlovian conditioning or hypnotic drugs.³³

PRACTICE PROBLEMS

20. Recalling some concepts from the chapters on learning: social behavior is most like (a) a reflex; (b) a goal response; (c) imitation; (d) pursuit behavior.

Rate each of these communications on a scale of 1, 2, 3, 4, 5, on which 1 means pure persuasion, 5 means pure education, 3 is in the middle, etc.

21. ____ An automobile salesman demonstrates to a customer how fast his new car will go.
22. ____ A teacher explains how to use a microscope.
23. ____ A paint company prepares a booklet on how its paints should be mixed.
24. ____ A professor explains why modern art is superior to medieval art.
25. ____ The U.S. Department of State establishes Bibliothèque Benjamin Franklin in Paris.
26. From your study of this chapter predict what a dictator will do as soon as he gets into power.
27. Under what conditions will those in favor of segregated education learn more anti-segregation statements than those opposed to segregated education?³⁴
 - a. When the receivers expect to debate the issue.
 - b. When the receivers are below average in intelligence.
 - c. When the receivers are poorly informed.
 - d. When two or more different media are used.
28. People who are opposed to segregated education will be more likely to remember which of these arguments?³²
 - a. The present inferior condition of the Negro is the result of long and effective suppression by the Southern whites.
 - b. The real reason why most Southern whites oppose integration is their realization that the Negro is more capable than they are.
29. Two implausible statements follow.³² Which type of people, those in favor of segregated education or those against segregated education, would remember statement a better than statement b?
 - a. If Negroes and whites were meant to live together, they never would have been separated at the beginning of history.
 - b. The real reason why most Southern whites oppose integration is their realization that the Negro is more capable than they are.
30. From the principles of this chapter would you expect that prisoners who were indoctrinated by the Chinese Communists and collaborated with them would have more education, or less, or about the same, as those who resisted such indoctrination?

Group Processes and Structures

We have noted that society is organized in overlapping groups and that these groups attempt to persuade others and to influence the social development of the young. Now we must move up closer to get an inside view of the groups' activities and see how they operate.

When six or eight people are assembled and asked to work together, several interesting things happen. One visible aspect of this social interaction may be noted simply by recording how much people accomplish when working alone and when working with others. Usually, at least at first, the presence of other people increases motivation. This does not necessarily mean that they work better in a group. In most experiments of this kind people working together for a short time turn out more work and also make more mistakes than when working alone. But increased activity is only the most superficial effect of social interaction. If the group continues in association, new social processes are initiated, the study of which requires more ingenious methods.

Methods. The most direct method is to observe a group of people at work, such as a committee planning a picnic, a board of directors appointing a manager, or a small college class solving a problem, and record all the various things they do. Usually the social interaction goes pretty fast, and more than one observer is needed to catch everything, but after some practice the observers can record how often each person communicates and to whom. More than that, the communications can be classified in such categories as: greeting, seeking information, giving suggestions, giving orders, agreeing, opposing, summarizing, and so on. Or it may be more convenient, as when studying social interaction in an insurance office, to collect records of communication: letters, memoranda, mimeographed notices, invitations to lunch, purchase orders, travel orders, signatures of approval, and the like. Another method, less dependable but more convenient, is to ask people at the end of a meeting to try to recall who communicated with whom about what.

The interpersonal choices that people make disclose personal relationships that may result from previous group activities and may influence later group activities; hence some simple procedures, called *sociometric methods*, have been developed for describing the network of social choices within a group. Each person is given a list of the names of the others and asked whom he likes most and whom he likes least. Or he may be asked to name the two he likes most, and least. Or the one he would most like to work with, or dance with. The wording of the question is important because someone may be chosen frequently as a dance partner but not as a work partner, or the reverse.

TABLE 10.7. Frequency of Communication Between Members of a Group of Six Persons

	A	B	C	D	E	F	Totals
Aaron		30	3	2	10	2	47
Barbara			0	0	5	10	45
Charles				5	20	5	33
Deborah					15	3	35
Evelyn						5	55
Fiorello							25
Totals	47	45	33	35	55	25	

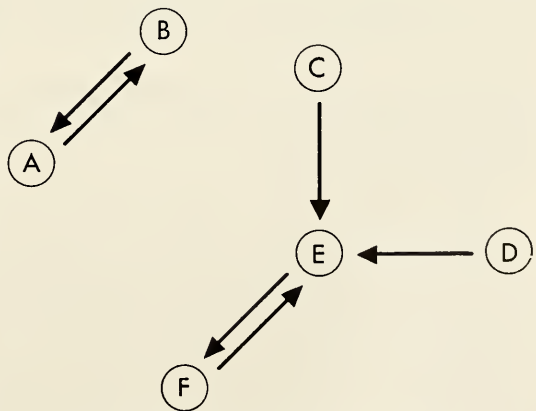
As an illustration, we can summarize amount of communication within a group of six persons, as in Table 10.7, which shows, for example, that Evelyn interacted twice as much as Fiorello, and that Barbara communicated

TABLE 10.8. Distribution of First Choices in a Group of Six Persons

Person Choosing	Person Chosen					
	A	B	C	D	E	F
Aaron		x				
Barbara	x					
Charles					x	
Deborah					x	
Evelyn						x
Fiorello					x	

mostly with Aaron. A sociometric analysis of this six-person group yielded Table 10.8, showing first choices. Aaron chose Barbara and Barbara chose Aaron. Evelyn was the most popular. Charles and Deborah were not chosen by anyone. These sociometric relationships can be pictured crudely, with arrows showing direction of choice, as in Fig. 10.7.

Differentiation of Activities. From research by these methods, and others, we know that when people get together and work or play as a group, new social processes begin and a group structure emerges. Whatever the motivation for getting together, the members

**Fig. 10.7.** Sociometric diagram of the choices shown in Table 10.8.

become differentiated from outsiders and, within the group, their activities are differentiated also. The most obvious differentiation from outsiders is the greater communication between members than between a member and an outsider. If this were not true, we could hardly call it a genuine social group. But within the group also there are large differences, even in amount of communication or group participation. In nearly all group interaction one can observe that participation is not uniformly distributed. One or two persons talk often, several talk occasionally, and many hardly at all. In most college classrooms, for example, the social norm prohibits frequent participation, and only a few deviate from this norm³⁵ (see Fig. 10.8). Those who do deviate from the norm to participate often in class discussion are not neces-

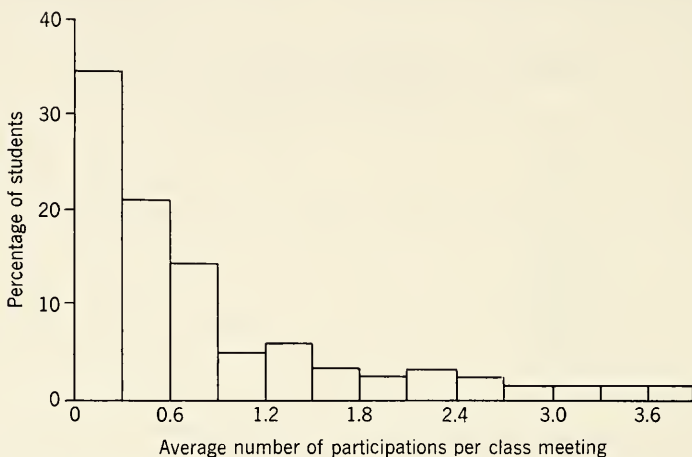


Fig. 10.8. Participation in the college classroom. Records were kept of participation in group discussion in four college classes in psychology of about 30 students each. Free discussion was encouraged. Half the students participated less than once in two days, while a very few had something to say more than three times a day. (From Smith & Dunbar³⁵)

sarily better informed or more interested in the topic than those who maintain a dignified silence. They are likely to be nonconformists, hardened to the role of participator.

One common result of membership in a group is identification with and loyalty to the group. At first the individual's motives for joining the group are individual motives, but later, if he gets involved in group activities and gets some satisfactions from them, group goals may outpull individual goals. We may say that he becomes ego involved with the group or that the group becomes part of his self concept. Instead of telling people that he belongs to the Maple City Wallonian Society, he tells them that he *is* a Wallonian. In such cases the group becomes a reference or standard against which the individual evaluates his conduct. That is why membership in various refer-

ence groups, such as a labor union or a professional group, is a strong determiner of attitudes and opinions. There are individual differences, naturally, in group loyalty, and many organizations try to strengthen it by having their members wear special buttons or uniforms. European students often grow beards to symbolize their membership in the confraternity of students.

Informal groups with no previous organization are fluid at first, and changes in structure occur frequently. A person may commence social interaction with anyone: the closest person, a person who resembles someone with whom interaction in the past has been rewarding (transfer of training), one who seems to have common interests, or one who appears to have high status or power. Roles are similarly fluid at first: one near the door becomes a doorman, or one adopts a role that he has been accustomed to in other groups. Gradually the group structure becomes solidified as people abandon contacts and drop out of roles that are annoying and maintain those they enjoy. Group norms are developed. After some jockeying for position the status of each person within the group becomes specified, at least roughly. Then, if we observe carefully and classify the interactions, we will detect channels of communication and differentiation of activities within the group. These relations may change as new members enter the group and as the external situation changes, but unless the structure has some stability and a fair percentage of the members are satisfied, the group breaks up. As a rule, informal transitory groups react according to the situation and the problems, while groups with a stable group structure react according to their own norms.

More formally organized groups, such as those listed earlier in this chapter, have a more definite structure from the beginning, either by election of officers or by appointment from above. There are group norms specifying the channels of communication and the rights and duties of each member which have become solidified by tradition or perhaps written in a rule book or policy statement. The most impressive role, of course, is that of leader, called variously chairman, president, chief, director, and Worthy Supreme Grand Matron. Other well-recognized roles are secretary, messenger, bouncer, and consultant.

In addition to observing groups that are already structured, psychologists have been able to establish group structures experimentally in the laboratory by manipulating the network of communication between the members. In one study of communication nets in groups of five men each the men were separated by partitions with passageways which the experimenter could open or close.³⁶ The communication patterns which were used, called circle, chain, Y, and wheel, are shown in Fig. 10.9. The problems were complicated ones requiring the exchange of information by passing notes through the

open passageways. Closing passageways changed the channels of communication and altered the group structure. When the group activities were analyzed, it appeared that in the wheel pattern the peripheral men funneled information to the center man, C, who made decisions and returned answers.

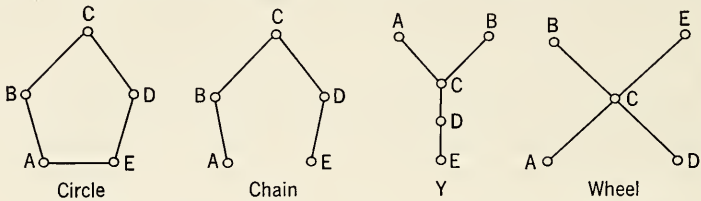


Fig. 10.9. Experimental arrangements of communication patterns. When groups of five with problems to solve were allowed to communicate only by these channels, the wheel was the most efficient, the circle the most enjoyable. (From Leavitt⁸⁶)

In the Y pattern the center man, C, made the decisions, while D transmitted information both ways. There was no consistent organization of communication in the circle; messages were sent and answers returned in both directions. All groups improved as they worked successive problems, but in general the wheel was the most effective network of communication, then the Y, the chain, and the circle. As to enjoyment of the task, the order was reversed. The circle was most enjoyable, for all members had a chance to participate and make decisions. The wheel pattern was disliked, except by the man who was in the middle having all the fun. Thus we see, as in the preceding chapter, that the principles of work performance and of work satisfaction are not the same. Other experiments have demonstrated that the effectiveness of a group structure depends also on the nature of the task, for some tasks can be performed by one superior performer with little help from others, while other tasks require a certain level of cooperation from all and any interference with communication would impede group performance.

Do Groups Think Better Than Individuals? If a problem can be done either by a group or by individuals, it is intriguing to compare these two ways of solving problems. Such comparisons are usually limited to temporary laboratory groups and to artificial problems for which correct solutions are known, but the results illuminate the general advantages and disadvantages of group thinking.

When five individuals judge the temperature of a room or the length of a line or the population of Juneau and the judgments of the individuals are averaged, this average judgment of the group usually has a smaller error than the average of the errors of the five individuals. Suppose, for example, that the five temperature judgments were 65, 68, 70, 71, and 76 degrees, and the true temperature according to a good thermometer was 69 degrees. The group judgment is the average of these judgments, which is 70, with

an error of 1 degree. The five individual errors were 4, 1, 1, 2, and 7 degrees, or an average of 3 degrees. One individual may be more accurate than the group average but, if we cannot identify the accurate individual, it is better to accept the group average. This, of course, is a statistical effect, the result of the averaging, that has nothing to do with social interaction. The average of five thermometers is more accurate than any one thermometer picked at random, and so is the average of five individual judgments, even if the individuals have no interaction with each other.

If social interaction does occur while the judgments are being made, the effects of conformity to group pressures can usually be observed. If the individuals announce their judgments and discuss them, and then judge again, the deviations of the individual judgments from the group average will be smaller on the second round. In a typical case, if the five judgments noted above were given on the first round, after discussion these judgments might be 67, 69, 70, 71, and 73. In this case the group average did not change but the deviant judgments moved closer to the group norm, and the average of the five individual errors is now 1.8 degrees rather than 3 degrees. As a general principle, when the group average is near the true value, conformity pressure decreases the individual errors. If the group is way off the true value, perhaps because of a common illusion, or lack of information, or prejudice, the conformity effect does not reduce errors; it may increase them.

When several individuals get together as a group to think up ideas to solve a problem, the group is likely to produce more different ideas than any one individual. This too is not a social effect but is a consequence of the fact that the individuals produce different ideas, just as several random samples of words taken from a dictionary will contain more different words than any one sample.

But when these individuals interact and discuss each others' ideas, we can see the advantages and disadvantages of group thinking. Being in a group may raise activity level and stimulate all kinds of activity. One may add to and build on the ideas of others, and another member of the group may criticize an idea better than the one who produced it. On the other hand, some people are inhibited in groups, especially if the group has more than two or three members. Conformity to the group pressures may discourage the production of original ideas. Some experiments have shown that many good ideas get lost in group discussion.³⁷ Other experiments indicate that the ideas contributed by those who talk a lot are more frequently accepted by the group than the ideas of the quieter individuals.³⁸ And when one is approached later and asked what went on during the discussion, it is his own ideas and interpretations that he recalls best.³⁹

Since group interaction introduces both advantages and disadvantages, an overall comparison requires careful planning. In one experiment college

students had to work 30 reasoning problems in which prejudice could distort logic. For example: Which is the correct conclusion from these premises?

Some Communists are advocates of heavy taxes;
All advocates of heavy taxes are conservative Republicans;
Therefore:

- Some advocates of heavy taxes are not Communists.
- Some Communists are conservative Republicans.
- Some conservative Republicans are Communists.
- Some Communists are advocates of heavy taxes.
- None of these conclusions follows.

Some students worked in small socially interacting groups and had to reach a group decision cooperatively. Others worked as individuals and were scored as individuals but were also scored as if they had been in groups reaching a decision by majority vote, without any discussion. The majority decisions were slightly better on the average than the individual decisions though not as good as those of the best individual in each group. But the genuine group decisions were the best of all⁴⁰ (see Fig. 10.10). It is on prob-

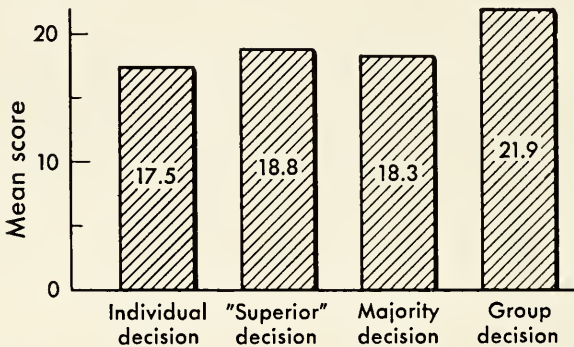


Fig. 10.10. Individual and group judgment. Comparison of average scores for logical reasoning by individuals, by the "superior" individuals in each group, by majority vote, and by cooperative group decision. (Data from Barnlund⁴⁰)

lems of this type that group discussion allows the liberals to catch the errors of the conservatives and the Republicans to expose the prejudices of the Democrats.

Deciding among five conclusions is not the same as inventing a solution. An experiment on productive thought divided 48 individuals into groups of four each to work together, thinking up new ideas, as in the procedure popularly called "brainstorming." Also, 48 other individuals worked the same problems alone, and the groups of four produced more ideas, as one might expect, than single individuals. But this is comparing four against one. When the ideas produced by the 48 who worked alone were artificially

grouped by fours for comparison with the real groups of four, the averages showed that those who worked alone produced many more different ideas and many more unique ideas.⁴¹

Comparing these two experiments suggests that the advantage of group discussion is critical rather than productive, showing up in problems of decision rather than problems of production. Other experiments have shown that diversity of opinion in the group aids group discussion, and it is easy to see, in the case of the problem printed above, that groups composed of all Republicans or all Communists might let some obvious fallacies slip by.

Leadership

For centuries the role of the leader, his relations with his followers, his personality, his victories and defeats have fascinated playwrights, poets, historians, and biographers. Nations have followed the strong man into battle and have strung him up by the heels, while philosophers have struggled with the universal problem of the power of the leader vs. the liberties of the people. Thus one could approach the study of leadership through the writings of Plutarch, Shakespeare, Woodrow Wilson, and Adolf Hitler. The psychologist's contribution has been to observe living leaders of less heroic stature as they operate in military, business, and government organizations, to record what they actually do, and to work out principles of selection and training of leaders.

Activities of the Leader. What does a person do when he is in a leadership position that is different from what he does when he is an ordinary member of a group? The answer is not as obvious as the question and considerable research has been directed toward an answer, usually at the request of military and industrial organizations. In a general way we can classify the leader's activities under two headings: (1) achievement of the goals of the organization, which may be producing spark plugs, winning a battle, or selling shoes, and (2) maintenance of personnel relations. The goal-oriented functions include planning work, setting up the group structure and the channels of communication, evaluating outcomes, and making decisions affecting progress in all of these functions. These activities are specific to the type of organization because planning the production of sparkplugs is different, in technical details, from planning a battle or a sales campaign. The personnel functions of the leader, directed toward the satisfactions of the people in the group, include building group loyalty and identification with the organization and its goals, recognizing the contributions of individuals, and reducing interpersonal friction, as well as promoting his own status as leader. Personnel functions are thus social functions, roughly similar in all social groups.

All members of a group may do all of these things now and then, but a larger proportion of the leader's time is devoted to them. Leadership is a kind of social interaction, like communication, persuasion, cooperation, and competition, but the interaction is focused through and by the leader. Communications flow to him and from him but—and this is almost a definition of leadership—communications from him direct the activities of the group. He makes decisions; hence we say he has power.

Groups seldom operate in isolation. They usually have relations with other groups and usually are part of a larger organization or institution. Interaction between groups on the same level is often channeled through the leader; interaction between a group and superior levels almost always goes through the leader. Whether he conceives himself as the "kingpin" or the "messenger boy," he is in fact the middleman in a flow of communications.

Effectiveness of the Leader. When we ask about the competence of the leader, we ask an almost impossible question because a good criterion of successful leadership is hard to find. The ideal criterion would be a measure of the goals reached by several similar groups working in similar conditions under different leaders. If the groups and the conditions are truly similar, differences in achievement must be due to differences in leadership. Since these conditions are very difficult to arrange, the common practice in most organizations and in most research on leadership is to obtain ratings of the effectiveness of the leader, made either by the leader's superiors or by those working under him. Everyone agrees in principle that the goal-oriented functions of technical planning and the personnel functions of increasing satisfaction are both necessary, but in most actual situations superiors give higher ratings to a leader who emphasizes achievement while subordinates give higher ratings to one who emphasizes consideration for personnel. The leader himself, caught in the middle of these two sets of social pressures, makes his decisions and distributes his efforts according to his own habits and ambitions and, if he is flexible, according to his diagnosis of weaknesses in the group structure or function.

Since the leader is a middleman in a network of communications, a large part of effective leadership is effective communication. This means mastery of the general language and often of special vocabularies. The foreman in a steel mill in Pennsylvania, for example, may need Polish to talk to his crew, the technical vocabulary of steel production to talk to his superiors, and the special vocabulary of time cards, social security forms, and union rules to talk to the payroll office. The general manager of the mill has to be able to communicate with foremen, chemists, salesmen, accountants, union officials, company attorneys, and personnel psychologists, as well as the board of

directors. But it is more than a matter of direct communication. The effective manager understands what the chemists want whether they express it directly or just drop hints. In general the successful leader listens to what his subordinates say in the language of job satisfaction and translates their wants into the language of production goals when talking to his superiors. Communications in the other direction have to be similarly translated, and thus we can say that good leaders are bilingual.

To go beyond these generalities it is necessary to examine formal and informal groups separately. In small informal groups the leader, e.g., a foreman or an office manager, may put his shoulder to the wheel and work beside the other members of the crew. In larger formal groups this is usually ineffective because the leader's leadership functions, the planning, communicating, and deciding, are more important. In formally organized groups effective leadership requires conformity to the organization, "going through channels," more than in informal groups where the structure is fluid. Subordinates in such formal organizations, though they like a leader who is friendly, will often vote instead for a leader who can help them because he knows the ropes and has friends at the top. Informal task-oriented groups also may pick a leader for his productive skills rather than for social reasons. Men who are going to fly together or fight together are likely to choose a leader for his competence rather than for his friendliness. A group of students seeking a tutor to help them prepare for an examination will choose on the basis of productivity rather than sociability. In these groups we can say that the job satisfactions of the individuals and the group goal of the leader coincide. It is in the large formal groups, organized from above, that the subordinates often feel that the supervisor identifies too strongly with management's goals; hence they prefer a leader who shows consideration for their satisfaction and morale.

If there are alternative ways of reaching a group goal—and there usually are—the effective leader gets the group to decide which way to go. Research has shown that a decision reached by this democratic procedure is often more enthusiastically accepted and executed by the group than one imposed from above. There are other situations in which the leader can increase goal achievement, not directly, by emphasizing production, but indirectly, by improving working conditions and emphasizing job satisfaction. In both these cases the effective bilingual leader translates his superior's emphasis on production goals into an emphasis on good personnel relations.

Naturally the kind of leader a group prefers depends to some extent on the personalities of the members of the group. People who place a high value on power want a strong authoritarian leader, regardless of his personal warmth, and feel uncomfortable with a weak leader. Equalitarian people

prefer a leader with an interest in the members of the group as individuals.

Selection of Leaders. In small informal groups there is at first no definite differentiation of roles, and the leadership role may be taken by the one who is most talkative, most popular, or most interested in the work of the group. If the group meets just once or twice, anything can happen. But if the group is a task-oriented group that persists, they are likely to choose a leader who appears to further the interests that brought the group together. If the group came together to play ball, they will probably choose a superior player as captain. If they are organized to raise money, someone with a reputation in this field will probably be elected. Scientists usually elect a distinguished scientist. Boy Scouts choose a boy who personifies their ideals, while delinquent boys more often choose a roughneck. The characteristics of the leader are specific in some respects to the characteristics of the group because these productive or goal-directed functions are specific to the group.

In groups that are organized from above, e.g., a factory group, an office staff, a military unit, the leader is appointed by a board of directors, the home office, or by headquarters. One attains leadership in such organizations by personal popularity, by marrying the boss's daughter, by seniority, by buying a controlling interest in the company, or by building a record of successful accomplishment. It is wise for any ambitious young man or woman to find out the actual requirements for advancement in his own organization, though it is often difficult to outguess the person or board that makes the appointments. Some large organizations with long-term personnel programs are constantly looking for promising young men and women to try out in positions of leadership, and many are turning to psychologists and psychological research for help, both in selection and in training.

When leaders in many different kinds of groups are studied psychologically and compared with other members of the groups, the leaders usually demonstrate greater knowledge and skill in their own field. A foreman in a paint shop usually knows paint and the production procedures in his branch. An office supervisor knows how to schedule work and whom to call to get a typewriter repaired. These abilities are specific, of course, to the specific functions of the group. Beyond these specifics, however, research has disclosed some more general abilities common to leaders in many different groups. Intelligence is the trait that most often differentiates leaders from others, because such leadership functions as planning, evaluating, communicating, and teaching depend on intellectual skills.

Some personality traits have been found to differentiate leaders from others, but these are not so general; there are many exceptions. As one might expect from noting their social functions, leaders are often more sociable, more socially skillful, and more self-confident. Anyone who shrinks from social contact is uncomfortable in a leadership role. Several

researches have emphasized the sensitivity of the leader because he has to understand the complaints, the interests, and the special abilities and disabilities of those below him as well as the demands of those above him, whether they are directly expressed or merely hinted. The good leader is usually a good listener as well as a good talker. Since the pressures from above and below are greater on the leader than on other members of the group, several investigations have stressed the importance of self-control. The leader has more opportunities to blow up, and the results are more serious when he does. All this makes the leadership role a hard job; most leaders are energetic people with strong achievement motivation. The leadership role attracts them because of the money rewards, the power, or the opportunities for self-expression on the grand scale. A promising method for finding people with the motives and skills to do all this, the leaderless-group technique, puts strangers together in an informal group to work on a common task and records who emerges in the leadership role. Methods for testing the other traits will be described in the next two chapters.

One principle that explains why it is difficult to generalize about the personality traits of leaders is that the requirements for successful leadership change as the membership of the group changes and as the group problems change. If the composition of the group shifts in personality, interests, or goal orientation, the demands on the leader shift also. Even if the group remains constant, economic conditions external to the group may change, increasing or decreasing task orientation and work satisfaction within the group. The techniques required of the leader of a revolution are different from those required of the leader after the revolution is won and administrative problems arise. A very flexible leader, sensitive to weak spots in the functioning of the group, will shift his activities in the same direction or perhaps, to balance the weakness, in the opposite direction, so he himself will appear to be a different person.

Training of Leaders. The selection of potential leaders is not the only answer to the problem of leadership because the differences, noted above, between leaders and others are all rather small, and because no one starts out as a leader. A college graduate, for example, usually gets his first job on the basis of his technical training, then finds, as he advances in the organization, that he takes on more and more leadership functions and becomes more and more involved in problems of human relations. Leaders train themselves on the job or, in recent years, receive training based on the modern psychology of leadership. Many large organizations have executive training programs, some of which consist mostly of learning the structure of the organization, the name and birthplace of the founder, whether to make out a travel voucher in triplicate or quadruplicate, and other details

peculiar to the organization. But some consist also of training in general principles of human relations and group processes. From rereading the past few pages one can see that modern human relations training for executives consists in large part of learning about structures and processes of social groups, how to estimate motives and satisfactions of members of a group, how to communicate with superiors and subordinates, what superiors and subordinates expect from a leader, and how to detect human problems before they become serious.

Intergroup Relations

As people work in a group and develop attitudes toward its members, called the *in-group*, they also develop attitudes toward members of other groups, called *out-groups*. The members of the White Springs Rotary Club have attitudes toward the members of the Pawnee Rotary Club not only as individuals but as Rotarians. The two groups have similar group norms and group goals, and a visitor from White Springs would feel at home in a meeting of the Pawnee club. Before we meet people and judge them as individuals, we often prejudge them according to the groups with which they are identified, so we need to know how attitudes toward groups are developed. By and large, attitudes toward groups are formed much as attitudes toward individuals and objects are formed. In general we can say that the members of a group develop favorable attitudes toward the members of an out-group when the two groups work toward the same goals; they develop unfavorable attitudes toward the out-group when that group appears as a threat or obstacle to attainment of the in-group goals.

A direct demonstration of this principle brought two groups together at a summer camp in such a way that the goals of both groups could be experimentally manipulated.⁴² There were 22 ordinary middle-class boys about 11 years old, divided into two similar groups and taken to camp separately, where they lived separately. During the first week each group developed its own group structure of friendships, symbols of identification, and leaders. One group called itself the Rattlers, the other the Eagles. Each appropriated a bunkhouse, a hide-out, and a swimming place as its own.

Then events were arranged which brought the two groups together in competition and reciprocal frustration. As an illustration, a tug of war was held (see Fig. 10.11), and the Eagles were frustrated by defeat, so they burned the Rattlers' flag. The Rattlers retaliated by raiding the Eagles (see Fig. 10.12). And so on. Each group accused the other of playing dirty and withdrew from social contact. At this stage, Stage 2, they referred to members of their in-group by such terms as "brave," "tough," and "friendly," and to members of the out-group as "sneaky," "smart alecks," and "stinkers." The



Fig. 10.11. Rattlers vs. Eagles. Stage 2. (Figs. 10.11–10.15 from Sherif & Sherif⁴²)



Fig. 10.12. Rattlers display blue jeans captured in raid on Eagles and inscribed "The Last of the Eagles" Stage 2.

left half of Fig. 10.13 shows that at the end of Stage 2 the out-groups were described by unfavorable terms more frequently than by favorable terms.

The next stage of the experiment, Stage 3, brought the two groups together to work toward common goals and overcome common frustrations. The two groups had to communicate, plan joint projects, and carry out their plans. For example, the water supply for the whole camp gave out, and the food truck failed to start. Faced with these difficulties the groups cooperated, but they preserved their group identities. When photographed for Fig. 10.14, Rattlers and Eagles were both pulling on the truck, but the Rattlers were all on one rope and the Eagles were all on the other. When the truck stalled

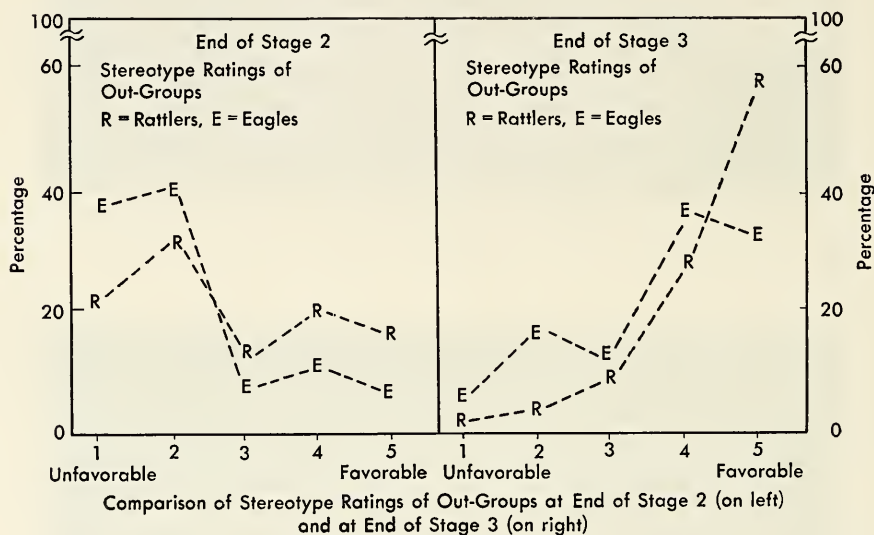


Fig. 10.13.

again, Rattlers and Eagles pulled on the same rope. After a series of these exercises in cooperation, sociometric analysis indicated that friendship choices were beginning to cross group lines. From Fig. 10.15 we see that Rattlers' choices of Eagles rose from 6 percent to 36 percent, and Eagles' choices of Rattlers rose from 8 percent to 23 percent. Looking back to Fig. 10.13, we see in the right half that at the end of Stage 3 the out-groups were described preponderantly by favorable terms.

Social Distance. In the above experiment the two groups came into direct personal contact. But people also learn attitudes toward groups with which they have no contact. Most Americans, for example, have had little personal contact with Turks; their attitudes toward Turks are acquired in the socialization process from family, school, newspapers, movies, and perhaps jokes. Attitudes toward some ethnic groups are a rather stable part of our culture

and thus most children acquire attitudes toward these groups before any actual contact. One method for studying anyone's attitude toward an out-group is to ask him if he would be willing to admit a Turk "To close kinship by marriage" or "To citizenship in my country." People will let some groups come closer than others, so this is called a scale of *social distance*. In one study of the attitudes of a broad sample of native Americans toward many ethnic groups in 1926, 54 percent would admit Germans to close kinship by marriage, 67 percent would admit them to their club as chums, 79 percent to their street as neighbors, 83 percent to employment in their occupation,



Fig. 10.14. Rattlers and Eagles vs. truck. Stage 3.

and 87 percent to citizenship in the United States.⁴³ The corresponding percentages for Negroes were 1, 9, 12, 39, and 57. When the study was repeated in 1946, an overall increase in tolerance appeared, but the various ethnic groups remained in approximately the same order.⁴⁴

Prejudice. A prejudice is a prejudgment, an attitude about something, usually a person, preceding actual contact. If someone does business with Mr. Stone and acquires a dislike for him, we do not call it a prejudice, but if he dislikes all jewelers and therefore dislikes Mr. Stone before he sees him, we can say that he is prejudiced. Prejudices can be favorable but most that we read and hear about every day are derogatory, and that gives us a clue to their origin. Going back to our general principle of intergroup relations, it

seems historically that prejudices against out-groups begin when the out-group appears to threaten attainment of in-group goals. In the 19th century, when the Chinese were needed in the United States as domestic and factory workers, they were described as sober, inoffensive, and peaceful. When economic conditions changed and they appeared as competitors for jobs, they were described as clannish, deceitful, and superstitious. The prejudice against most minority groups increases during times of unemployment and decreases when people feel that their jobs are safe.

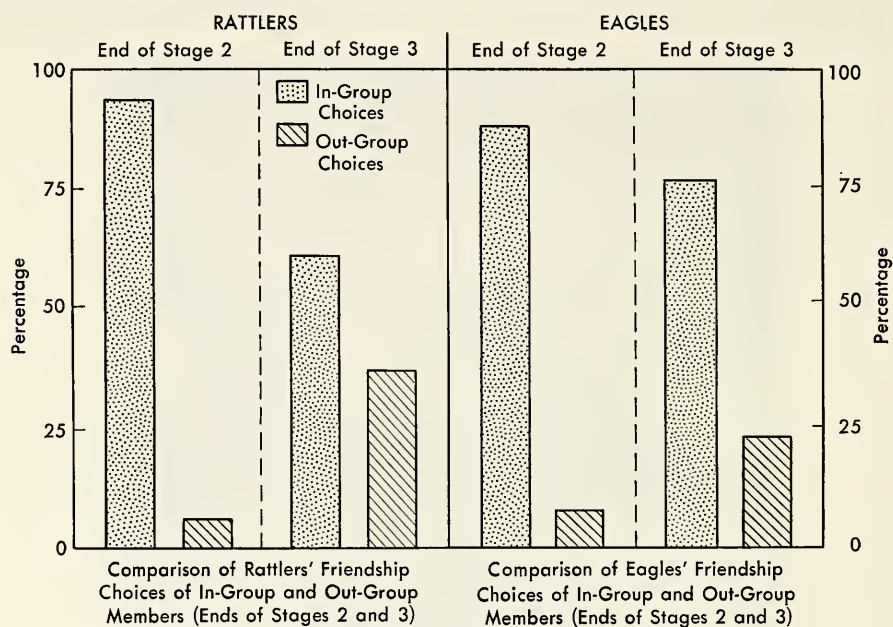


Fig. 10.15. Friendship choices of Rattlers and Eagles following intergroup friction and intergroup cooperation.

Regardless of historical origins, the prejudices that are in the culture are learned by children as they grow up and are passed on by them to their children. Children are not worried about unemployment, like some workers, or a supply of cheap labor, like some employers, but they soon learn from their parents and other adults that their own nationality is better than others, that their own religion is better than others, and that their own school is better than others. Most of the social devices used to increase identification with the in-group increase discrimination against out-groups.

Stereotypes. We can get a different kind of information about intergroup relations by asking members of one group to describe members of another. "What are Turks like?" "What are Texans like?" Or we can give them a list of adjectives: "sly," "industrious," "musical," "dirty," "militaristic," and so on,

and ask them to check the ones that are most characteristic of the Turks. Several investigations have supplied a list of 84 adjectives commonly used to describe people and, knowing how much one Turk differs from another, we might expect that all adjectives would be used equally often. But this does not happen. In 1932, when Princeton college students were asked to characterize the Turks by adjectives from the list, many of the adjectives were not used at all while "cruel" was used by 54 percent. "Scientifically-minded" was applied to the Germans by 78 percent, "artistic" to the Italians by 53 percent. Negroes were characterized primarily as "superstitious" and "lazy." In fact the first five adjectives in Table 10.9 account for over half the characteriza-

TABLE 10.9. Adjectives Used by Two Generations of College Students to Describe Negroes

Adjective	1932	1950
Superstitious	84%	41%
Lazy	75	31
Happy-go-lucky	38	17
Ignorant	38	24
Musical	26	33
Ostentatious	26	11
Very religious	24	17
Stupid	22	10
Pleasure-loving	—	19

SOURCE: Gilbert.⁴⁶

tions of Negroes.⁴⁵ We see here a strong tendency to describe Negroes, not as individuals, but as a type. The technical term is *stereotype*. One has a fixed image or concept of a group and sees the individuals as conforming to this rigid concept; thus he can describe them in a few words.

The index of group stereotyping is the number of adjectives necessary to account for half the descriptions. In the 1932 study half the descriptions of the Germans involved only five different adjectives, the Jews only six, the Irish nine. The stereotype of the Turks was not so clear-cut, for 16 adjectives were required. When the next generation of Princeton students was tested in 1950, many of the same adjectives were used for these groups, but the stereotyping tendency was much weaker. According to the same index of stereotyping 12 adjectives were now necessary to characterize the Negroes, 6 for the Germans, 11 for the Jews, 18 for the Irish, and 32 for the Turks. Furthermore, many students protested strongly against such unreasonable generalizations about individuals.⁴⁶

Americans are not the only ones who stereotype out-groups. In 1952 Armenian high school girls living in Lebanon⁴⁷ characterized Turks as "crimi-

nal" (85 percent), "base" (56 percent), and "deceitful" (51 percent). They called Negroes "enslaved" (47 percent), "ignorant" (42 percent), and "strong" (30 percent). These Armenian girls pictured Americans as "travelers" (58 percent), both "rich" (52 percent) and "scientific" (51 percent).

The learning of stereotypes is much like the learning of prejudices. American children learn that Turks are cruel and Negroes are happy-go-lucky just as they learn that angels have wings, professors are absent-minded, and Santa Claus is fat. As Chapter 7 pointed out, concepts are labor-saving devices in communication and thus the reinforcement of a fictitious concept is about the same as the reinforcement of a valid concept. In fact a person talking to an Irishman may be influenced more by his stereotype of Irishmen than by the behavior of the person in front of him. This is another demonstration of the strong tendency of human beings to make generalizations, some of which are useful and some of which are harmful.

Preceding chapters have pointed out also how the set influences perception and recall; this principle may in some cases strengthen stereotypes. If a person familiar with the stereotype of librarians expects librarians to look and act like old maids, he is likely to perceive and remember the cases that fit his preconception. These will reinforce the stereotype, while the negative cases will not extinguish it because he is not set to notice them. Hence, almost everyone has an opportunity to acquire and use stereotypes. Some use them innocently, through carelessness, or lack of education, or to strengthen a weak joke. Others use them, when frustrated, as instruments of verbal aggression.

Working against these habits are the editorial policies of the more enlightened magazines and newspapers and the educational activities of most schools and churches, together with any abatement of the social and economic conditions that motivate intergroup conflict. Table 10.9 proves that changes do occur; the old Amos-and-Andy stereotype of the Negro is on the way out, at least among educated people.

Although the development of an unfavorable stereotype about a group has often been associated historically with prejudice against that group, this is not always the case. Stereotypes can develop about a group that is known only through oversimplified communications from a prejudiced source or about a group that is so well known that it is described with considerable uniformity. When Australian college students were asked to describe various ethnic groups, it was the English who were stereotyped most, the Australians themselves next, and the Americans third. And these were the groups that were the best known and the best liked. These Australians did not like the Japanese, Koreans, and Egyptians, but apparently they did not know them well enough to describe them in stereotyped terms. In this educated sample familiarity with a group, liking for the group, and tendency to stereo-

type the group were all closely related.⁴⁸ (We shall see in Chapter 12 that stereotypes increase accuracy of judgments of personality in certain special situations.)

SUMMARY

Man's activities are influenced by the geographic environment and by the man-made cognitive environment, the culture. Typical activities vary as we travel from one culture to another, or even from one subculture to another, because of differences in attitudes, norms, and beliefs. These activities are structured by social groups, including peer groups, of many types, large and small, formal and informal, permanent and temporary, organized for work and for play.

An important dimension of the human environment is status, which in our culture depends on income, occupation, and parentage. High-status people differ from low-status people in expenditures, attitudes, and class identification. Thus, for many scientific and commercial purposes, we need a representative sample of the whole population and perhaps representative samples of different classes. Several sampling procedures have been developed for such purposes.

The socialization of the individual toward the pattern of the adult culture is a comprehensive learning process in which the child's maturing drives and abilities interact with social pressures and opportunities. But the social forces which influence the child are not altogether consistent; there are differences in child-training practices, family customs, and educational and occupational expectations associated with the economic class and education of the parents. Peer groups, as well as commercial, religious, and political pressures also slant the child's development one way or another. One result of all this socialization is conformity to the social norms. Observations of behavior show that conforming acts are most frequent; deviations from the norms of action and belief are less frequent. The deviations from conformity originate in individual motivations, inconsistencies of socialization, and cultural encouragement of independence.

Many patterns of interaction between people can be distinguished, beginning with the most primitive, communication, in which one man's R is another man's S. Communicative responses also conform to social norms; verbal communication in particular is highly standardized. In general the persuasiveness of a communication is a compromise between the forcefulness of the communication, working in one direction, and the self-control of the receiver, working in the other direction. More specifically, the communicator with prestige has an advantage, and the receiver with intelligence and education has an advantage, both in comprehension and in criticism. The receiver's

motivation may lead him to accept and recall the whole message or acceptable bits of it, to ignore the whole topic, or to remember the points he wishes to attack. Specific communications, especially about important events, are more effective than general exhortation. In modern times these messages are sent via many media of communication, each with its own set of advantages and disadvantages in respect to speed, cost, flexibility, circulation, and prestige. Control of the media of communication by any group or class is injurious to a democratic society, which profits from nonconformity of attitudes and beliefs.

Group processes are studied by observing groups in action, by collecting records or recollections of group interaction, and by sociometric methods. From such methods we know that members of a group are differentiated from others and that their activities within the group are differentiated. Different members play different roles, and thus social interaction is structured, whether this structure develops casually or is formally adopted. Groups can also be structured in the laboratory by experimental manipulation of the channels of communication so their effectiveness can be investigated. A collection of the judgments or productive contributions of several thinkers is usually better than one alone, but, beyond this statistical effect, group interaction as such may be either an advantage or a disadvantage.

The leader of a group struggles to achieve the goals set by or for the group and also to keep the group satisfied. Subordinates usually vote for a leader who puts the emphasis on group satisfaction, while superiors prefer a leader who meets production goals, though under the best conditions these two aims may coincide. In general, the leader is a middleman in a flow of communications; he translates communications from below into the language of those above, and the reverse. When the members of a group elect a leader, they are likely to choose one who appears to be able to further their interests by his promises, his skills, or his record, or one who can act as a symbol of the group ideals. When the leader is appointed from above, many considerations are involved, including psychological traits and previous usefulness to the organization. Many organizations now have executive training programs for finding and developing potential leaders, some of which are based on the psychology of leadership.

Relations between members of one group and members of another are usually friendly when the two groups have common goals and common problems to discuss. If one group appears to frustrate the other in pursuit of its goals, intergroup hostility develops. But most such hostility develops in advance of actual contact. Stereotypes and prejudices, like favorable intergroup attitudes, become available to the individual as he acquires the culture, and then he uses them in communication through carelessness, as

instruments of verbal aggression, or to build group support. Such hostile attitudes are reduced by education and by practice in intergroup cooperation.

PRACTICE PROBLEMS

31. A simple experiment on social facilitation compared the output of 10 people working alone with the output of the same 10 people working together. What are the two common dependent variables in such an experiment?
32. How many values has the independent variable in such experiments?
33. Sociometrically, the group described by Table 10.8 could be called (a) two groups instead of one; (b) a group without any structure; (c) a homogeneous group; (d) a collection of six isolated individuals.
34. In research on the composition of air crews airmen in basic training were given tests of achievement motive and affiliation motive. Later, when they were asked to choose partners to work with, some chose their friends while others chose men who had previously been successful in this work.⁴⁹ Which men chose their friends?
 - a. Men of high achievement motive and high affiliation motive.
 - b. Men of high affiliation motive and low achievement motive.
 - c. Men low in both motives.
 - d. Men of high achievement motive and low affiliation motive.
35. Thirty girls, aged 12 to 16, all strangers but all from middle-class families, come together in summer camp. What develops first?
 - a. Differentiation of roles.
 - b. Common group norms.
 - c. Common group goals.
 - d. Friendship groups of three or four girls each.
 - e. A communication network.
36. High school students were arranged, on the basis of teachers' ratings and sociometric data, into informal groups of three each, in each of which one was clearly of high sociometric status, i.e., a leader, one was clearly of low sociometric status, and one was in the middle. Then each group played a game of throwing darts at a target and the group guessed each member's future performance.⁴² Which one of the three would be expected by the group to make the highest score?
 - a. The high-status member.
 - b. The middle-status member.
 - c. The low-status member.
37. Which one would have the lowest expectation of his own performance?
38. Suppose, instead of estimating future performance, such groups observe performance in hitting a target that is not very well marked and judge accuracy. Which person will be overrated?
39. Which of these acts by a leader of a formally organized group would be most likely to cost him his position as leader?
 - a. Delegation of power to an expert on a special task.
 - b. Loss of personal popularity.
 - c. Deviation from group expectations of leadership behavior.
 - d. Expressions of unfriendliness to members of group.

40. In the experiment with the Rattlers and the Eagles what was the independent variable?
41. When leaders and non-leaders are tested by an intelligence test, leaders usually score higher. In which group would you expect to find the larger difference of this kind, a group of clerical workers or a team of biological scientists?
42. If you were an employer looking for a college student with social skill for a selling job, which would you choose?
 - a. A student with many friends.
 - b. A student who has been elected to a class office.
 - c. A student who has had several courses in psychology.
 - d. A student who has had several courses in sociology.
 - e. A varsity athlete.
43. Why do college students use stereotypes less than non-college people?
 - a. More identification with the out-group.
 - b. Fewer frustrations.
 - c. Less in-group identification.
 - d. More skill in communication.
44. Does Fig. 3.7 agree with the stereotypes of businessmen and clergymen?
45. If you were getting a group together to plan ways of raising money, would you prefer members of similar backgrounds or different backgrounds?
46. Students of psychology and sociology were divided into groups of five persons each, and each group was given the case of a nine-year-old problem boy to discuss.³⁸ Half the groups were encouraged to compete within the group and the other half were encouraged to cooperate. Which groups produced the most ideas?
47. Which terms are synonyms? (a) Pressure group—primary group; (b) socialization—negativism; (c) peer group—stereotype; (d) social status—reputation.
48. In which pair of terms is the second an example of the first? (a) Social distance—demagogue; (b) social class—negativism; (c) social status—socialization; (d) primary group—family.
49. In which pair of terms does the second depend on the first? (a) primary group—family; (b) primary group—socialization; (c) stereotype—sociometric methods; (d) negativism—suggestion.
50. Which of these statements would be an argument for the hypothesis that leaders are selected on the basis of a stereotype?
 - a. Bishops are taller than clergymen.
 - b. Officers are more intelligent than enlisted men.
 - c. Corporation presidents are often sons of corporation presidents.
 - d. Many U.S. senators were formerly college professors.
51. The sociable person enjoys people for their own sake. The socially skillful person treats people as (a) pieces of a social organization; (b) links in a chain; (c) means to an end; (d) goals.
52. Cross out the term that is not a part of social skill: (a) emotional control; (b) social insight; (c) adaptability; (d) assimilation; (e) responsiveness.
53. Which communication pattern of Fig. 10.9 permits the most communication? (Hint: Count channels available to each person.)
54. There are many definitions of a social group. Which of these is *not* such a definition?
 - a. A collection of people in social interaction.
 - b. A collection of people of similar social background.

- c. A collection of people with interrelated roles.
- d. A collection of people with shared norms.

In the description of social groups which of these terms are observables (mark them Obs) and which are constructs (mark them Con)?

- 55. _____ Group norm
- 56. _____ Number of communications
- 57. _____ Social roles
- 58. _____ Social distance
- 59. _____ Prejudice
- 60. Many people believe that if you stare at a person's back a long time, he will turn around. This illustrates (a) an old superstition; (b) a primitive form of social interaction; (c) a subtle kind of communication; (d) the influence of suggestion.
- 61. All societies have some social norms restricting sexual behavior. True or false?
- 62. "The only good way to eliminate prejudice is by personal contact." Is this true?
- 63. The "great man" theory of leadership and the environmental theory of leadership both suffer from the same defect. Which one?
 - a. Interaction between individual and situation is neglected.
 - b. Psychological attributes of greatness are not clearly understood.
 - c. Environmental demands cannot be precisely specified.
 - d. Great men are not selected from the environment at random.
- 64. Under what conditions are task-oriented citizens most likely to get involved in politics?
 - a. When the goals are clearly defined.
 - b. When politicians are self-oriented.
 - c. When legislative units appear to be ineffective.
 - d. When legislative units appear to be task-oriented.
- 65. One study of social class and child-training practices up to age three in California around 1930 made use of actual observations of maternal behavior and found that class differences were not the same for boys as for girls.⁵⁰ Which would you expect were allowed more freedom, the boys of high socioeconomic status or the boys of low status?
- 66. Which would you expect were allowed more freedom, girls of high socioeconomic status or girls of low status?
- 67. In raising children which type of family would make the sharpest distinction between male and female roles, bureaucratic or entrepreneurial?

Attitudes, like other things, are acquired and changed by several kinds of learning. Match each event with the kind of learning it illustrates.

- 68. A college freshman tried several approaches to get in with a certain group of boys, but they ignored him until one day he related some scandals about a businessman in his home town that he used to work for. When he went home for the holidays, he did not feel like asking for his old job again. (a) Operant conditioning; (b) selective learning; (c) cognitive organization; (d) identification.
- 69. A man who usually voted as a Democrat because his father did tried to predict what a Democratic victory would do to his income and subsequently voted Republican. (a) Operant conditioning; (b) selective learning; (c) cognitive organization; (d) identification.
- 70. A farm girl's city friends stopped what they were doing and listened to her whenever she told funny stories about farmers, and gradually she began to

dislike her former farm friends. (a) Operant conditioning; (b) selective learning; (c) cognitive organization; (d) identification.

Discussion Questions

- A. What are the principal similarities and differences between the popular term "culture" and the technical term "culture" as it is used by social scientists?
- B. In a city of about 200,000 the building of a municipal art museum was under discussion by the aldermen, so the local newspaper printed a ballot on the front page and asked the readers to cut it out, mark it Yes or No, and mail it to the newspaper. In what ways would you expect this sample to be biased?
- C. Look at a college class as a social group and describe one that you are familiar with in respect to communication pattern, group roles, group norms, media of communication, and pressures for conformity and independence.

Recommended Reading

- R. Firth. *Human types*. Mentor, 1958. Despite the title this is a paperback introduction to social anthropology. Racial traits, social structure, and economy in a wide range of cultures, with some interesting photographs from New Guinea.
- C. A. Gibb. Leadership. In G. Lindzey (Ed.), *Handbook of social psychology*. Vol. II. Addison-Wesley, 1954. A systematic survey of research on definitions of leadership, activities of the leader, relations between leaders and followers, and types of leadership.
- I. L. Child. Socialization. In G. Lindzey (Ed.), *Handbook of social psychology*. Vol. II. Addison-Wesley, 1954. Evidence from many cultures on how a child grows into his own culture. Toilet training, aggression, achievement, sexual behavior, and anxieties. Techniques of socialization.
- G. Allport. *The nature of prejudice*. Addison-Wesley, 1954. The nature and extent of prejudice examined and clarified with the aid of psychological and sociological principles.
- M. Rokeach. *The open and closed mind*. Basic Books, 1960. A report of a series of researches attempting to differentiate people according to their reactions to other people who hold different beliefs. The significance of the results for dogmatism, intolerance, rigidity of thought, and ideological conflict.



The Psychological Corporation, 304 East 45 Street, New York, N.Y.

Chapter 11. ABILITIES AND TESTS

At this point we reach a major division in the science of psychology. The preceding chapters have outlined general principles of behavior that apply more or less to everyone. Some people learn more than others, to be sure, but the experiments have included many different people and have averaged the results to arrive at a general principle. Let us suppose, for example, that the lower curve of Fig. 11.1 describes how Mr. Stone learned the meanings of a long list of unfamiliar words with several days' practice, and the upper curve describes how Mr. Dirk learned the same list. If we were in-

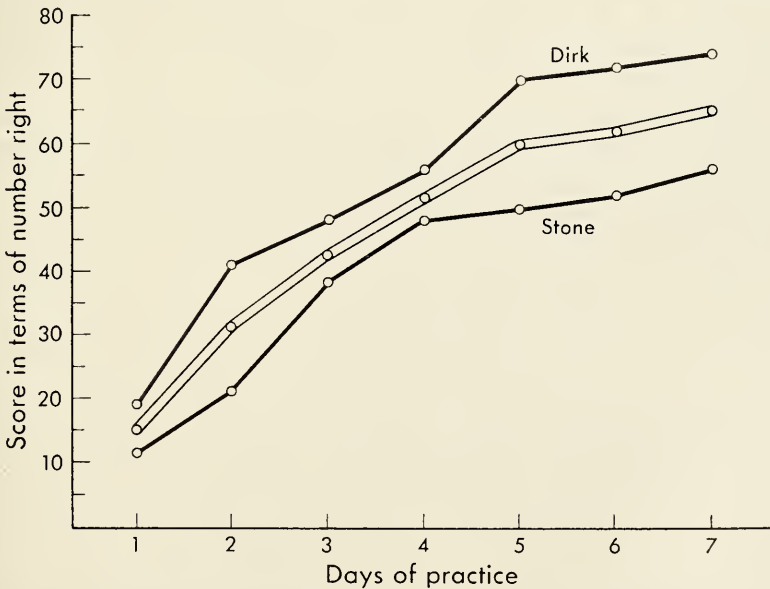


Fig. 11.1. General principles and individual differences. The light line shows average performance or the general trend while the heavier lines show the performance of the two individuals separately.

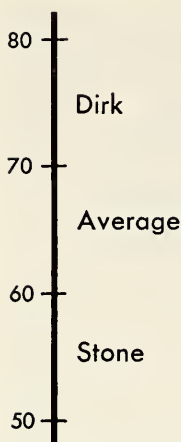


Fig. 11.2.

terested in general principles, we could average the data and get the middle curve, which shows the general trend of improvement with practice. But in this chapter we are interested in Mr. Stone and Mr. Dirk as individuals, so we use the scores to describe each person's performance—ignoring the general trend for the moment. Thus if we test them on the 7th day of practice, Stone gets a score of 56, Dirk gets 74, and the average is 65. In many situations, as in an employment office or a psychological clinic, previous practice and motivation are unknown, but the individuals can still be compared in respect to performance at any one time, as in Fig. 11.2. That branch of psychology that examines people and describes their similarities and differences is called *differential psychology* or the *psychology of individual differences*.

Each response, we know, depends on both the situation, S, and the individual, O. To study individual differences we need a situation in which

one individual can make one response, $\begin{matrix} S \\ O_1 \end{matrix} \rangle R_1$, while another individual can

make a different response, $\begin{matrix} S \\ O_2 \end{matrix} \rangle R_2$. A psychological test is a standard pro-

cedure that can evoke different responses from different individuals in a standard situation and summarizes these responses as scores that can be used to compare the individuals.

Obviously, in order to study individual differences in ability we have to consider the effectiveness of the behavior, so we need a situation which evokes responses that can be classified as failures and successes. When we speak of a person's *ability*, we mean what he can do, but we never observe what he can do; ability is a construct, not an observable. We estimate a person's ability by observing successes and failures in a standard situation under optimal conditions, that is, when he is adequately motivated and not tired or distracted. An *ability test* is one which yields responses that can easily be scored as successes and failures, and the person who makes the most successes in this standard situation is said to have the most ability. Individual differences in abilities are considered in this chapter; individual differences in responses that are not easily scored as right or wrong, such as social interactions, are considered in the next chapter under the broader topic of personality.

In an average year about 90 million psychological tests are administered to about 30 million people in the United States. Historians will record that

the development and use of psychological tests was one of the outstanding scientific trends of the 20th century. The great variety of tests in present use are classified and named according to the ability being tested, the purpose for which the tests are used, the method of testing, and in several other ways. When tests are named for the ability being tested, they are referred to as tests of intelligence, mechanical ability, finger dexterity, space perception, and the like. When tests are named according to the purpose for which they are used, they may be called achievement or aptitude tests. An *achievement test* is used to get a measure of performance or knowledge after a learning period, like the tests used in school at the end of a course and the tests given to typists applying for a job. Contrasted with these are *aptitude tests*, used to predict future performance, like those given to college freshmen at entrance and those given to candidates for a pilot-training program. Achievement and aptitude tests may look similar, but the one samples the achievements the subject is supposed to have learned and the other attempts to predict what he will learn.

Tests are often designated as group and individual tests, according to the method of administration. *Group tests* are easy to use, requiring no complicated instructions and relatively little skill to administer. For this reason they can be given to large groups of subjects at once. *Individual tests* are more difficult to administer, so the examiner, who must be specially trained, can test only one person at a time. When tests depend heavily on language skill, either in understanding the instructions or in answering the questions, they are often called *verbal tests*, as opposed to *performance tests*, in which the subject manipulates objects, like blocks and tools, and the language factor is reduced to a minimum. When a test has been given to large numbers of people and the results statistically analyzed so that the meaning of each score is known, the test is called a *standardized test*. Tests not yet standardized are used only for research or for special temporary purposes. After a test has been standardized, it is usually placed on the market and sold to qualified examiners.

CONSTRUCTION AND STANDARDIZATION

One of the easiest tests to construct is a vocabulary test because the dictionary is a convenient source of questions and answers. We need not use all the words in the dictionary. We can use only a sample of the words, just as, in the preceding chapter, we used only a sample of the public to make inferences about public opinion. One standard abridged dictionary has 1421 pages, so we can make a little seven-word test by systematically taking the last usable word on every 200th page. On page 101 we find *baseball*, on page

301 *cyclopedic*, on page 501 *gastritis*, and so on to *trump* on page 1301. Adding to each a synonym and three alternative words that are not synonyms, we have a brief vocabulary test that we might call Test 7A.

VOCABULARY TEST 7A

Which one of the four words at the right is most similar in meaning to the word at the left? Underline it.

1. BASEBALL dance game cut watch
2. CYCLOPEDIC exhaustive circumferential atmospheric productive
3. GARRULOUS cheap edible loquacious noxious
4. LEXICON law chemical preparation wordbook
5. PERIODIC oral regular criminal attractive
6. SENATE supplement quality labyrinth assembly
7. TRUMP dive dissolve beat whimper

The important assumption here is the one we make in all sampling procedures, namely, that one who knows a large percentage of the words in the sample knows a large percentage of the words in the dictionary. Hence, within the limits of the sampling procedure, the score on the test is a measure of the construct that we call vocabulary, word knowledge, or verbal ability.

We frequently need another test of the same kind, so we sample the dictionary again in the same way, page 201, page 401, and so on, to page 1401, and we have a parallel test, which we shall call 7B.

VOCABULARY TEST 7B

Which one of the four words at the right is most similar in meaning to the word at the left? Underline it.

1. CHAOTIC instrumental basic disorderly instructive
2. ENTREATY contradiction appeal corridor tariff
3. ILLIMITABLE boundless traditional wrong poetic
4. MUSH melt help descend travel
5. RAMBLE wander dash develop wound
6. STUDIO lamp farmyard drug workroom
7. WISP fabric tuft yearning joke

It is possible to construct a test of arithmetic ability, e.g., for the eighth grade, by this sampling procedure if we have a list of problems or a syllabus that defines arithmetic ability at this level. When achievement is defined as mastery of a textbook, an achievement test may be constructed by a systematic sampling of the textbook, as by taking a problem from every fifth page.

Some tests are constructed not so much to sample learned achievements as to predict future events, like success on a job. Aptitude tests used to select men and women who can pass an expensive training course are of this type. There is no list of problems to be sampled so the psychologist has to search

for critical abilities that separate the successful from the failures. He picks up hints from complaints of foremen and supervisors, from records of unusually good or unusually bad performance, and from firsthand observation of good and poor employees in action. These ideas are put into the form of test items: verbal questions and problems printed on paper, or performance items that may require simple apparatus. Thus, by one procedure or another, a sample of items is assembled as a test, now ready for a trial run.

Reliability

No measuring instrument, whether it is a psychological test or a thermometer, is perfectly reliable, but the difference between science and guesswork is that the scientist estimates the errors and takes account of them in his conclusions. The score on a psychological test includes several kinds of error, most of which are fairly well understood and can be reduced by careful construction and refinement of the test. For example, with a good intelligence test a qualified examiner can test a girl of 10 in an hour or so and get an IQ that has an average error of about 3 percent. That is, if the IQ is 90, there is an even chance that the error is not more than 2.7 IQ points in either direction. There is the same chance that the error is greater than 2.7 points in either direction.

One understandable way to estimate the error of our seven-word vocabulary test is to sample the dictionary repeatedly and make up 10 similar seven-word tests, which we can then give to a cooperative subject. Let us suppose our subject gets a score of 2 once, 3 twice, 4 four times, 5 twice, and 6 once, as shown in Fig. 11.3. His average score is 4 and if we accept that as the most accurate measure of his vocabulary ability, scores of 3 and 5 are off by one and scores of 2 and 6 are off by two. The total of the errors is 8, and the average error for the 10 tests is therefore 0.8. Naturally, if we had used longer tests, the error would be proportionately smaller. This is one good way to think of reliability—in terms of the error in a score due to the use of a sample of items rather than all possible items.

			x		
			x		
		x	x	x	
x	x	x	x	x	x
2	3	4	5	6	

Fig. 11.3. Scores on 10 vocabulary tests.

It is not practicable to make up so many similar tests to give one person, but it is easy to make up two similar tests, like 7A and 7B, and give them to many people. Test 7A will rank people from top to bottom in respect to vocabulary score and so will 7B. Reliability by this method is the agreement between these ranks and, if each test is a good sample of vocabulary ability, the agreement will be high. The measure of agreement is the correlation coefficient, widely used in the study of individual differences, but when used for this purpose, it is called a *reliability coefficient*.

As a simple illustration, we will compute rho, a correlation coefficient based on ranks, for five subjects who took Tests 7A and 7B and got the scores shown in Table 11.1. A made 4 on one and 7 on the other. B made

TABLE 11.1. Computation of Rank-Difference Correlation Coefficient

Subject	Scores		Ranks		Rank Diff.	D^2
	7A	7B	7A	7B		
A	4	7	3	1	2	4
B	5	3	2	4	2	4
C	2	1	5	5	0	0
D	3	4	4	3	1	1
E	7	6	1	2	1	1
						<u>10</u>

$$\rho = 1 - \frac{6\sum D^2}{n(n^2 - 1)}$$

$$\rho = 1 - \frac{60}{120}$$

$$\rho = 1 - .50$$

$$\rho = .50$$

5 on one and 3 on the other. The first step is to rank the subjects on the 7A test. E got 7, so he ranks 1. B got 5, so he ranks 2. A ranks 3. And so on. When ranked on 7B, A is 1, E is 2, and so on. The formula for rho requires D^2 , which is the square of the difference between the ranks on the two tests. A ranked 3 on one test and 1 on the other, so the rank difference is 2, and D^2 is 4, which is entered in the last column. Having found D^2 for each subject, we add these and get the sum, $\sum D^2$, which is 10. Substituting this in the formula below the table and remembering that n , the number of subjects, is 5 in this example, we get $\rho = .50$. (In actual practice we would use at least a hundred subjects and make slightly different computations, but the logic is the same.)

Reliability coefficients vary from 0 to 1.00, so a coefficient of .50 indicates low reliability—as one would expect from a test of only seven words. A reliability coefficient of 1.00 would mean that both tests rank the subjects in exactly the same order and, while that is too much to expect of any test, a well-constructed vocabulary test of 40 words would have a reliability coefficient of around .90. We do not always have to construct two forms of the test. After a test has been given to a hundred subjects, it is possible to compute the reliability of each item, that is, to compute how well each item agrees with the whole test. One item might have a correlation of only .25 with the whole test, but a test made up of 40 such items would probably have a reliability above .90. In general, lengthening the test by adding more items of the same kind increases the difference between the scores of the individuals

at the top and those at the bottom and thus makes the test as a whole more reliable.

Item Analysis and Improvement

Lengthening a test may be inconvenient for both subjects and examiners. The alternative is to refine or sharpen the test. We can think of a psychological test as a cutting instrument, dividing those who have high ability from those who have low ability. A dull instrument may do the job if we work at it long enough, but a sharp instrument will do it with more speed and precision. So the technique for improving the reliability of a test is to give a preliminary form of the test to a large number of subjects, then to analyze the results for each item separately, and refine and shorten the test by eliminating those items that are not consistent with the others.

Let us suppose that we gave a test to 200 subjects and divided these subjects into 100 with high scores and 100 with low scores. Even if the test is not very accurate at first, we can assume that those above the average have more ability than those below the average, and we evaluate each item on this assumption. Table 11.2 shows the percentage of subjects in each half who

TABLE 11.2. Data for Item Analysis

Item	Percent Right	
	<i>Lows</i>	<i>Highs</i>
1	70	95
2	40	80
3	50	30
4	10	40
5	80	82
6	10	13

passed each of the first six items. Apparently some of the problems were hard and some were easy but, more important, we can compare the number of lows who passed each item with the number of highs who passed each item. The first was passed by 70 percent of the lows and 95 percent of the highs. It is consistent with the test as a whole because those subjects who did well on this item did well on the whole test. Item 2 is even better because twice as many highs passed it as lows. If we computed the correlation of this item with the whole test, it would be about .50. When we look at Item 3, we see something peculiar. More lows than highs succeeded on this item, so it is inconsistent with the other items. Perhaps the wording of the item is not clear. Whatever the reason, this item is reducing the reliability of the test and should be eliminated. Item 4 is a difficult one, but it discriminates the

lows from the highs sharply, so it is a good item. Item 5 discriminates in the right direction, but the difference is so small that it is a waste of time and paper. The easiest words on the vocabulary tests might yield such results. Item 6 is also a waste of time.

Item #J-9-2

The principal reason why most humans are gregarious is that: 1. early needs are usually satisfied by other people; 2. enjoyment is enhanced among crowds; 3. gregariousness is inborn; 4. a person must seek a mate; 5. isolation breeds loneliness.

Responses	1	2	3	4	5	
Highs	90	2	8	0	0	Correlation
Lows	76	10	8	0	6	.23

Item #SNJ-58

Artists make use of one of the following to give the appearance of depth to their paintings. 1. Kinesthetic cues; 2. binocular cues; 3. vestibular cues; 4. binocular disparity; 5. monocular cues.

Responses	1	2	3	4	5	
Highs	4	20	1	4	71	Correlation
Lows	22	32	4	24	18	.54

Fig. 11.4. Analysis of the responses of 100 subjects with high scores and 100 subjects with low scores of two items on a test of achievement in psychology. #J-9-2 is an easy item since 90 percent of the highs and 76 percent of the lows chose the right answer. But the difference between the highs and the lows is small and the correlation with the whole test was only .23. The fourth alternative was not chosen by anyone, so the item could probably be improved by rewording this alternative to make it more attractive to the lows. #SNJ-58 discriminates very well between highs and lows and correlates well with the whole test.

A test of 40 items like Item 2 and Item 4 might have a reliability coefficient of .90 while one of 40 items like Items 1, 3, 5, and 6 might have a reliability only .50. Eliminating the items that do not discriminate the highs from the lows shortens the test without reducing reliability. Then if these are replaced by discriminating items, the reliability is increased. Such procedures are responsible for the high reliability of modern psychological tests. Most tests in regular use by qualified psychologists have reliability coefficients from .75 to .95 and score errors from 15 percent to 3 percent. Statistics on test items are often recorded and filed as shown in Fig. 11.4.

In terms of our skeleton formula, $\begin{matrix} S \\ \diagdown \quad \diagup \\ O \end{matrix} R$, the score on an ability test is the number of correct R's, and the aim of test analysis is to reduce score differences due to variations in S and increase score differences due to variations in the abilities of the O's.

PRACTICE PROBLEMS

1. What is the independent variable of Fig. 11.1? the dependent variable?
2. What can we say about the independent and dependent variables of Fig. 11.2?
3. If Stone and Dirk had been tested on the third day of practice, what scores would they have received?

4. Which of these topics from other chapters would fit most logically into this chapter? (a) Hunger drive; (b) attitude toward religion; (c) visual acuity; (d) emotional stability; (e) reinforcement.
5. Looking back to Fig. 2.6 what would be the optimal range of activation at which to test speed of reaction?
6. When four men competed in the hundred-yard dash, Judge X and Judge Y agreed as to the first man and the last man but disagreed as to the second and third. Compute the correlation between their judgments, beginning with Table 11.3.

TABLE 11.3. Order of Finishing a Race According to Two Judges

Runner	Judges	
	X	Y
A	1	1
B	3	2
C	2	3
D	4	4

7. A sixth-grade class took an arithmetic test in January and another in March covering the same material, and the correlation between the scores was .40. Why was it so low?
 - a. Arithmetic ability of the children changed.
 - b. Scores on each test included some error.
 - c. It is not possible to construct reliable tests at this age.
 - d. Both a and b.
8. Which kind of abilities would fluctuate most from one month to another, verbal abilities or performance abilities?
9. Consider the eight problems above as a test. Would you call it an achievement test or an aptitude test? group or individual? verbal or performance? standardized or unstandardized?
10. How could an arithmetic test be used as an achievement test and also as an aptitude test?
11. The important difference between verbal tests and performance tests is (a) the number of words in the instructions; (b) the causes of failures; (c) the percentage of educated subjects who succeed; (d) the movements made by the subjects.
12. A reliability coefficient is also called a coefficient of internal consistency. In what respect is a reliable test more consistent than an unreliable test?

Problems 13–18 refer to Table 11.4.

13. Pick an easy discriminating item.
14. Pick an easy non-discriminating item.
15. Pick a hard discriminating item.
16. Pick a hard non-discriminating item.
17. Pick the three items that should be discarded.
18. When the items of Table 11.4 were correlated with the whole test, one correlation coefficient had a minus sign, $-.05$. Which one was it?

19. Item analysis is a technique for selecting items that (a) are well written; (b) discriminate good readers from poor readers; (c) are consistent with other items on the test; (d) will fail those who have not studied the subject; (e) discriminate the intelligent from the dull.

TABLE 11.4. Data for Item Analysis

Item	Percent Right	
	<i>Lows</i>	<i>Highs</i>
1	91	93
2	13	15
3	40	62
4	18	33
5	81	97
6	60	54

Scores and Scales

If we give someone a psychological test and he makes a score of 37, what does this score tell us? Very little. No matter how reliable it may be, a single test score is no more helpful than a single light seen through a fog. As noted in earlier chapters, any object of perception or judgment needs a background or frame of reference before it can be interpreted. The same problem arose years ago when physicists began to measure temperature. They found stable reference points in the temperature at which water freezes and the temperature at which it boils, so they constructed scales based on these points, and now any degree of temperature has meaning in reference to such scales. Children learn a scale in school and from observation of thermometers, just as they learn other concepts, so a temperature of 37 comes to mean a certain location on a certain scale. By the same logic psychologists have invented scales based on the performance of specified groups of people, and have given the world new concepts to learn, like "mental age" and "intelligence quotient."

Age Scores. When Alfred Binet, the brilliant French psychologist, faced this problem at the beginning of this century, he was impressed by the large increase in ability that occurs during the years of rapid growth, so he took this range of ability as his frame of reference. The average child of 10 knows more words than the average child of nine. Children of 11 do better on nearly all tests than children of 10. This regular increase in abilities up to maturity is a dependable set of facts, which offers a good starting place for the construction of a scoring system. Binet arranged his tests in age levels, so that he would have reason to say that Pierre has the intellectual ability of the average child of 10, and Marie does about as well as the average 12-year-old. This conversion of performance on a test to an age score can be seen in Table

11.5, which is taken with some approximation from a modern individual test, the Wechsler Intelligence Scale for Children.¹

Tables like 11.5 are put together quite simply. The psychologist persuades a large cross section of children to take the test, then collects the tests of the

**TABLE 11.5. Age Equivalents
for a Vocabulary Test**

Age	Average Score
13	43
12	39
11	36
10	32
9	28
8	25

SOURCE: WISC.¹

8-year-olds and computes the average. If they are a representative sample, this average represents eight-year ability. On the Wechsler vocabulary scale children of eight got a score of 25 on the average. Children of nine made an average score of 28, and so on. We now know what children do on this test, and we can use this range of performance as a frame of reference to interpret the performance of a particular child. The two-column table is called a table of age equivalents or *age norms*, and we can use it to convert a test score into an equivalent age score. If Mrs. De Giacomo's little girl gets a score of 28, we can look in the table and see that her performance is typical of 10-year-olds, so her age score in respect to this test is 10. If the test is an intelligence test, the age score represents the intelligence age or the *mental age*, often abbreviated MA. Tables of age norms are available for most intelligence tests intended for use with children, so after the examiner has scored the test, he looks up the score in a table and converts it to an age score or MA. Any child's mental age is the age at which average children have the intellectual ability that this child has now.

The principal problem in making up a table of age norms is getting a representative sample of children to take the test. When the Wechsler test was standardized, it was given to 2200 white children drawn from four regions of the United States in proportion to the population of these regions. Rural and urban children were included in proportion to their population. Since intelligence is related to occupational level, the children were selected so that their fathers' occupations constituted a cross section of United States occupations according to the latest census. Hence the norms apply in general to United States white children.

The age scale is a simple but useful frame of reference for evaluating intellectual performance, and the MA has been helpful to psychologists in

courts, schools, and clinics. If a psychologist reports to the judge of the Juvenile Court that Julia was able to pass 37 items, the judge will be little the wiser. But if the judge is told that Julia has an MA of 10, the report makes more sense.

Percentile Scores. When these youngsters finish high school, the usefulness of the mental-age scale has ended. Intellectual functions, like the others discussed in Chapter 1, develop rapidly up to age 12, then development slows down, and after 15 the yearly increase is not large enough to form the basis of a scale. For adults, therefore, some other frame of reference is necessary, and one common scale for this purpose is the range of ability of a familiar group, such as college freshmen. Once this group has been tested, a table of norms can be constructed, and then the ability of any person can be expressed in reference to this group.

TABLE 11.6. Percentile Norms for a 20-Word Vocabulary Test Given to a Representative Sample of the Voting Population of the United States

Score, Number of Words Right	Percentage Making Each Score	Percentile Score
20	0.5	100
19	1.5	99
18	2.4	98
17	4.1	96
16	6.1	91
15	7.2	85
14	8.1	78
13	8.0	70
12	8.5	62
11	8.3	54
10	8.6	45
9	6.6	37
8	7.3	30
7	6.4	23
6	4.9	16
5	3.6	11
4	2.5	8
3	1.3	5
2	1.0	4
1	0.5	3
0	2.5	2

SOURCE: Data from Thorndike & Gallup.²

As an illustration, we can examine the results of a 20-word vocabulary test given to 3000 men and women, constituting a representative sample of the voting population of the United States.² Our frame of reference, then, is that portion of the population eligible to vote. The average score of these representative Americans was 11 words right; the percentage who received each score from 0 to 20 is shown in Table 11.6. Starting at the bottom of the middle column we see that 2.5 percent got scores of zero and 0.5 percent got

scores of 1. Therefore 3 percent got scores of 1 or less. One percent got scores of 2, so a total of 4 percent got scores of 2 or less. These cumulative percentages are shown in the column at the right and are called *percentile scores* or centile scores. We see that 91 percent of the sample got 16 right, or less, so a score of 16 corresponds to a percentile score of 91. By subtraction we can see that 9 percent of the sample did better than this. In general, the percentile score locates a person in reference to a group by showing the percentage of the group that scores below him. Eliminating the middle column, which is only for computation, Table 11.6 is known as a table of *percentile norms*, or percentile equivalents. With tables like this we can convert raw scores to percentile scores, just as we convert Centigrade temperatures to Fahrenheit, or dollars to pesetas.

Obviously a percentile score does not tell us much unless we know what people were tested when the table of norms was constructed. Table 11.6 is based on a sample of the United States electorate and other norms are based on high school students, college freshmen, and applicants for certain jobs. The important point to remember is to ask on what group the norms were based. Someone at the 30th percentile of a college population might be at the 45th percentile of ordinary adults.

When several tests have been standardized on the same group and a table of norms is available for each test, we can get a clear picture of the abilities of any particular individual. The raw scores may be confusing because a score of 40 on a mathematics test may be above average while a score of 73 on a reading test may be below average. A spelling test may be scored in terms of errors and a finger dexterity test may be scored in terms of minutes. But if we have norms for all tests on the same group, we can put all scores for one individual on the same scale. It may turn out, for example, that the mathematics scores is at the 45th percentile, reading at the 37th percentile, spelling 60, and finger dexterity 25. When scores from several tests are converted to one scoring system in this way, it is easier to evaluate the individual's strengths and weaknesses. Also the different scores can all be conveniently displayed in graphic form, as in the *profile charts* that appear later in this chapter.

Age scales are particularly convenient for use with growing children. Percentile scales have the advantage that nearly everyone is familiar with percentages. Other scaling systems have other advantages. While the average percentile score is always 50, other scoring systems put the average at 100. But all scoring systems are based on the same strategy: a test is given to a familiar group, and the scores of individuals are evaluated in reference to the scores of the group.

The IQ. Anyone who understands about mental ages and percentile scores is prepared to encounter the IQ, that remarkable scientific concept which escaped the obscurity of the psychological laboratory and became a popular

synonym for intelligence. Technically it is not a synonym for intelligence. It is another kind of score for expressing the results of an intelligence test, with certain advantages and disadvantages that age scores and percentile scores do not have. An advantage is that it can be used to compare a child's ability at one age with his ability at a different age, or to compare the abilities of different children of different ages. If Anne has an MA of 10 and Marvin an MA of 12, Marvin is obviously more intelligent than Anne. But if Anne is 9 years old and Marvin is 13, then in a relative sense Anne is the more intelligent, since she is above average for her age while Marvin is below average for his age. A boy who has an MA of 11 when he is 10 is above average for his age—10 percent above average, one might say. Another boy who has an MA of 9 when he is 10 has only 90 percent of average intelligence for his age. We use the same logic when we say that someone is "short for his age" or "strong for his age." Economists do the same when they quote prices in 1960 as a percentage of prices in 1949.

The formula reads: $IQ = \frac{MA}{CA} \times 100$. In this expression CA means chronological age or age according to the calendar, and MA is the mental-age score. The ratio of these two, or quotient, is multiplied by 100 to eliminate the decimal point and change the average quotient from 1.00 to 100.

The IQ is a useful score for a large-scale inventory of the nation's intelligence because IQ's for children of different ages can reasonably be put together in one table or graph. Table 11.7 and Fig. 11.5 show the distribution

TABLE 11.7. Percentages of IQ's in the U.S.

IQ Range	Percent
Above 130	3
110-129	24
90-109	46
70-89	24
Below 70	3

SOURCE: Terman & Merrill.³

of IQ's obtained when Terman and Merrill tested a representative sample of native white children for the 1937 revision of the Stanford-Binet test.³ We see that the average IQ is 100, as it must be if the test is properly standardized, and that about half the population have IQ's between 90 and 110. The percentages above 130 and below 70 are quite small.

When all these facts are put together, it is apparent that dividing MA by CA to get IQ is a convenient way of expressing intelligence independent of age. But it is not the only way. Separate percentile norms could be made up for each age group, so that we would have a table of norms for age five,

another for age six, and so on, with the average being 50 for each age group and the range extending from 0 to 100. But for many years psychologists, social workers, judges, and psychiatrists have become accustomed to the range of scores shown in Table 11.7, in which 100 is the average and most people fall between 80 and 120. Therefore, when the Wechsler Intelligence Scale for Children was standardized, the scores for the 5-year-olds were converted to a scale in which the average was 100, and the deviations above and below this average correspond to the familiar deviations of the old-fashioned IQ. Similar tables of norms were made up for the 6-year-olds, and the other age groups, so that it is now possible to convert the score of a child of any

age to a scale on which 100 is the score of the average child of that age and the range of scores is approximately the same as the familiar range obtained when MA is divided by CA. These scores are called IQ's—specifically, deviation IQ's—even though they are not actually quotients.

The question now arises whether a child will get the same IQ on two different tests, which use different scoring systems as well as different test items. The agreement is close enough for most practical purposes, but large discrepancies occasionally occur, so most psychologists are careful to report their findings as Stanford-Binet IQ or WISC IQ.

When the Wechsler Adult Intelligence Scale was standardized, the deviation IQ was used, as for the Wechsler Intelligence Scale for Children, so the distribution of IQ's would approximate the familiar distribution of children's IQ's.⁴ As we shall see later in this chapter, intelligence test scores are lower at the older ages, so this test has separate tables of norms for different age groups. If a man of 35 makes a score of 70 on the WAIS, he gets an IQ of 89, but if a man of 55 makes a score of 70, he gets a WAIS IQ of 97.

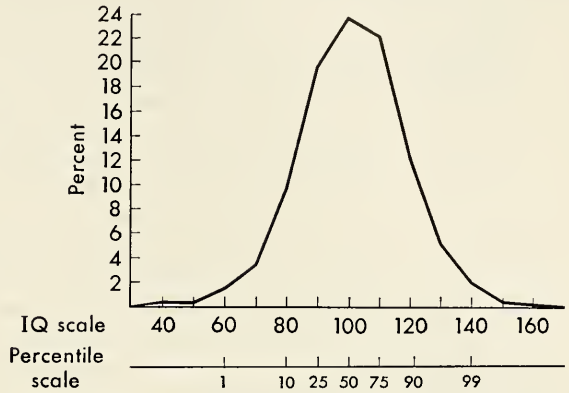


Fig. 11.5. Distribution of IQ's of white children in the United States around 1935. The baseline has been scaled in percentiles as well as IQ's. (From Terman & Merrill⁵)

PRACTICE PROBLEMS

20. Age scores are based on the age of (a) the person being tested; (b) others of the same age; (c) others of the same ability; (d) normal children of the same type.

21. David Stone, Jr., got 15 words right on the 20-word vocabulary test. According to the norms of Table 11.6 what is his percentile score?
22. How high a score would be necessary to get into the top quarter of the distribution of scores on the 20-word test?
23. If you wanted to pick off the bottom third of the distribution, where would you draw the line?
24. In a psychology class an eager student asserted that the familiar grading system, A, B, C, D, E, is a standard scale like the age and percentile scales. Which is the best argument for this assertion?
 - a. Results of different tests are converted to this scale.
 - b. The system is in use in many educational institutions.
 - c. Each letter grade always corresponds to the same performance level.
 - d. Each score is a summary of many responses.
25. What kind of test might have separate norms for men and women? (a) Spelling; (b) mechanical aptitude; (c) intelligence; (d) visual acuity.
26. When do we ignore a child's age, when we calculate his MA or his IQ?
27. Are IQ's for adults more like mental ages or like percentile scores?
28. If a child has an MA of four when he is five, what is his IQ?
29. John, age six, has an MA of eight and a sister of nine. If John and his sister are equally bright for their ages, what is her MA?
30. In 1960 in one typical American city there were 11,463 children attending school. Estimate the number with IQ's above 130.
31. A hundred ordinary children between 7 and 12 are given the Stanford-Binet test and the WISC. Guess the correlation between the IQ's obtained from these two tests: (a) .10; (b) .20; (c) .40; (d) .80; (e) .99.

ANALYSIS OF ABILITIES

If we are interested in intellectual abilities rather than motor or sensory abilities, we need a sample of tasks that require people to perform intellectual operations and solve intellectual problems. They must be easily scored right or wrong and, as a matter of convenience, fairly short. Some tasks like those that appear on printed intelligence tests are shown in Fig. 11.6. Some others cannot be shown on the printed page but are given orally, such as the span of immediate memory for digits, described in Chapter 6. Performance tests often include the assembly of blocks to make a certain design (see Fig. 11.7) and the arrangement of pictures to tell a story (see Fig. 11.8). Perceptual tasks like those shown at the end of Chapter 5 appear on some tests.

Since there is such a variety of tests, they must be classified in some way. Do they all test the same ability? Or does each test a different ability? How similar is the ability measured by an arithmetic test to the ability measured by a vocabulary test? The measure of the similarity between two tests is the correlation coefficient, which we have already met in the discussion of test reliability. The scores of a hundred subjects on two tests are correlated by a procedure like that shown in Table 11.1, and if the correlation is high, around .80, the abilities tested by the two tests must be about the same. If












1. Information: How far is it from New York to San Francisco?
2. Comprehension: Why do fire trucks have sirens?
3. Similarities: In what way are A and Z alike?
4. Verbal analogies: Aunt is to uncle as niece is to _____?
5. Numerical analogies: 2 is to 4 as 5 is to which of these numbers?
15 20 25 30 35
6. Figure analogies:  is to  as  is to which of these?
    
7. Space: 1 is to  as  is to which of these?
 4 5 6 7

Fig. 11.6. A few typical intelligence test items.

the correlation is low, around .20 or less, the abilities required for the two tests are quite distinct. For example, when 200 boys and girls of age 10 took the Wechsler Intelligence Scale for Children, their scores on the vocabulary test correlated .75 with their scores on the comprehension test but only .48 with their digit span scores. The object assembly test correlated .59 with the block design test but only .28 with the information test. This procedure is



Fig. 11.7. An item from the Block Design test of the Wechsler Adult Intelligence Scale.

used to answer the old questions that Aristotle asked about the nature of abilities and also to develop efficient tests for a modern technological society. (The same correlation procedure will be used in the next chapter to uncover relations between personality traits.)

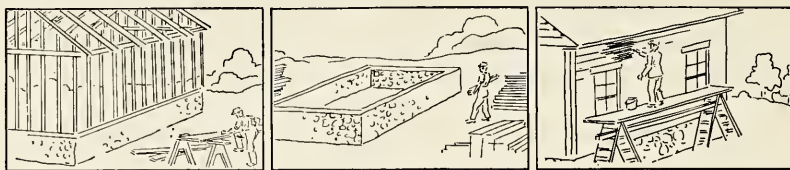


Fig. 11.8. An item from the Picture Arrangement test of the Wechsler Adult Intelligence Scale. (Courtesy The Psychological Corporation)

PRACTICE PROBLEMS

A good way to become familiar with correlation coefficients is to guess at a few. Guess the correlation between:

32. Height and weight in a class of college freshmen.
33. High school grades and college grades.
34. Intelligence test scores and college grades.
35. Scores on a vocabulary test and scores on a test of reading comprehension.
36. Height and mechanical ability.
37. Head size and intelligence.
38. One reliable vocabulary test and another.
39. One reliable vocabulary test which is scored by counting the number right and another which is scored by counting the number of errors.
40. Two standard intelligence tests.

General Intelligence

One way to classify tests is to put them all together in one general category. This is a logical procedure because the tests are all related; a person who does one of these little tasks right is more likely than not to do the others right. Years of research have shown that the scores on one test are correlated with the scores on most other tests; in other words, the ability required to succeed on one test overlaps the ability required to succeed on others. When many heterogeneous items are put together as a test, the special ability required for any one item contributes relatively little and the total score a person gets depends largely on his general ability, required in some degree by all items. This common overlapping ability, which operates so helpfully throughout the diverse problems of the intelligence tests and the even more diverse problems of daily life, is called the common factor in intelligence tests, or general ability, or *general intelligence*.

Many of the modern tests of general intelligence have emphasized this general factor by item analysis. Items that are too specific, that is, that do not correlate well with the other items, are eliminated, so the contribution of

general ability to the total score is increased. Thus more than half the variance of the scores on the Wechsler Adult Intelligence Scale can be allotted to the general factor.⁵ The high scores of superior subjects and the failures of the mentally defective come mostly from those items which show a high overlap with the general factor.⁶ It is tests of this kind, highly weighted with general intelligence, that are most suitable for computation of an IQ. And a person who gets a high score on one good test of general intelligence will get a high score on another good test of general intelligence, though there may be a difference in the absolute value of the IQ. Much of the scientific evidence on intelligence, coming later in this chapter, was obtained with tests of general intelligence.

This statistical concept of general intelligence becomes clearer if we recall, from the chapter on thinking, the operations involved in the solution of problems and ask why a person who does better than average on some problems is likely to be better than average on others. Problem solving requires adopting and maintaining a set, that is, attending to the pertinent aspects of the problem, and anyone who has sufficient control of attention for one kind of problem probably has sufficient control for other kinds. All tasks more complex than a reflex require at least a minimal amount of this ability, and those who cannot maintain the proper set fail while those who can succeed—if they have the other abilities as well. Also, we know that when one begins work on a problem, he has a background of information and experience that helps him, and an alert, interested person who has picked up a lot of knowledge has a better chance on all problems. Problems that depend on specialized experience, like knowledge of the materials used by bushelmen, are eliminated by the item analysis. But, above all, the solution of difficult problems of all types requires various abstract operations, as when one reorganizes the problem in imagination and manipulates concepts and symbols of things instead of the concrete objects. Hence, reasoning or abstract ability is at the center of general intelligence, and problems involving similarities and analogies, such as Nos. 3, 4, 5 and 6 of Fig. 11.6, show considerable overlap with the general factor of intelligence test items. The words on vocabulary tests are mostly abstract concepts, which depend on previous experience and ability to manipulate abstractions; hence vocabulary scores correlate highly with scores on general intelligence. For example, vocabulary scores and total scores on the Wechsler Intelligence Scale for Children correlate .83 at the 10-year level.

Differential Abilities

Just as it is possible to emphasize the general factor and construct one test of general intelligence, it is possible to group similar items together and construct several tests of different abilities. Such multi-factor tests are called tests

of primary abilities, differential aptitudes, or *differential abilities*. They are usually arranged in a set or battery and standardized on the same sample so that scores for all tests are on the same percentile scale and can be conveniently graphed on a single profile chart. For example, the Differential Aptitude Tests, a battery of group tests widely used in high schools, have separate tests of verbal reasoning, numerical ability, abstract reasoning, spatial relations, mechanical reasoning, clerical speed and accuracy, spelling, and sentence construction.⁷ The College Qualification Test, frequently given to college freshmen, has tests of verbal ability, numerical ability, and information.⁸ Each of these tests yields a reliable score and thus has some usefulness by itself; in addition, the total score on such test batteries usually is a fair measure of general intelligence.

Scores on such tests are correlated, so we cannot claim that the abilities are completely independent of each other. But the correlations are relatively low; hence it commonly happens that a boy gets average scores on most tests but a significantly high score on one or two tests—or the reverse. Thus these tests of differential abilities seem to provide a little more information than a single test of general ability. Fig. 11.9 is a profile chart showing the scores of a high school girl obtained from the Differential Aptitudes Tests. We shall see later, under the heading “Validity of Tests,” that tests of verbal ability and numerical ability have different functions in the college situation.

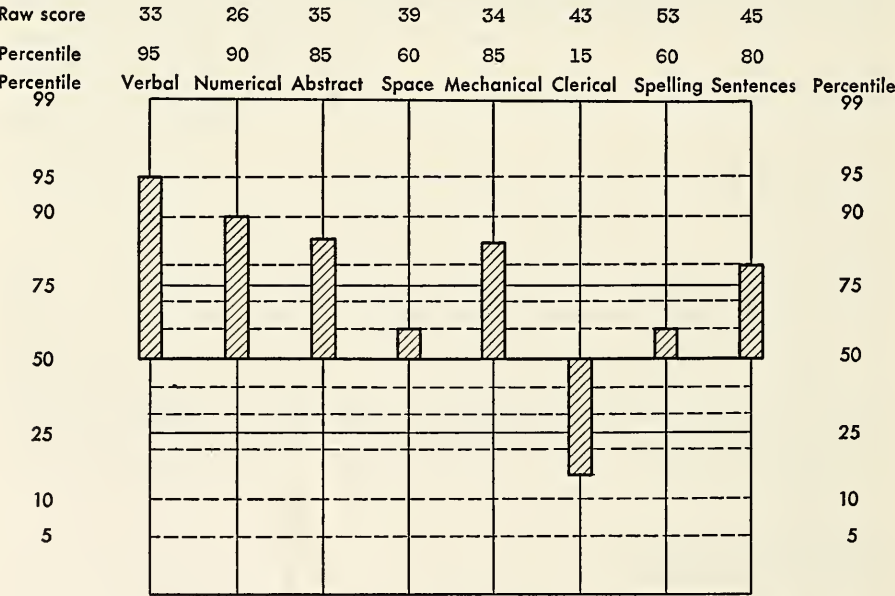
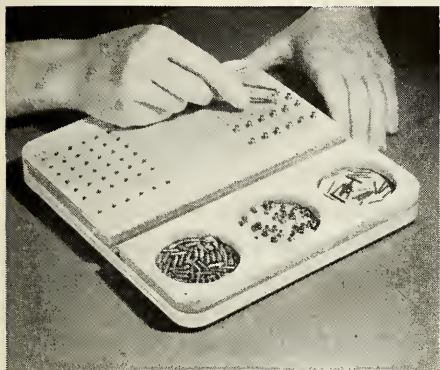


Fig. 11.9. Scores of a high school girl on eight different tests. This graph, unlike many other column graphs, has its origin at the middle score of the standardization group, the 50th percentile; the columns extend up and down from this line. (From Bennett, Seashore, & Wesman⁷)

In addition to such batteries many tests of specialized abilities have been devised: musical discrimination, manual dexterity, typing speed, skill in the use of tools, color discrimination, and others (see Fig. 11.10). These special

Fig. 11.10. Performance tests. The Bennett Hand-Tool Dexterity Test and the Crawford Small Parts Dexterity Test. (Courtesy The Psychological Corporation)



abilities are only slightly correlated with general intelligence, and thus they supply additional information, especially about applicants for specific jobs.

Hereditry and Environment

Geneticists prefer to study the inheritance of characteristics that are easy to see, like size and color, in organisms that breed rapidly, like banana flies. Good scientific evidence on inheritance in human beings, who take 20 years or so to breed, is meager, and most of that evidence applies to physical characteristics, such as eye color, blood type, and rare medical disorders. Intelligence, however, is one psychological trait that can be measured with fair accuracy; hence psychologists and geneticists, looking at the great range of intelligence represented by IQ's from 20 to 200, would like to estimate how much of this variance is due to variations in the genes that people are born with and how much is due to environmental variations.

In the construction of intelligence tests psychologists avoid items that depend on special environmental advantages. No one would put in a question about the size of berths in a Pullman car or how to milk a cow because success on these questions is obviously influenced by environmental opportunities. Instead, they ask questions like "What is the thing to do when you fall down and skin your knee?" hoping to test abilities that can be acquired by experience in any environment. The item analysis also helps to eliminate

items that are too specialized. Thus the question of the inheritance of intelligence is in part a question of how well the psychologists have succeeded in doing what they tried to do. If a perfect intelligence test, one not influenced by environmental advantages and disadvantages, could be constructed, there would be no question about the relative influence of heredity and environment on the scores obtained from it. The important question today, however, is not about a hypothetical test but about the intelligence tests of today, and the answers tell us about the meaning of the scores on these tests as well as about human genetics.

General Estimates. We know from the preceding chapter that favorable heredity and favorable environments usually go together. Parents of superior intelligence transmit their genes to their children and, as a rule, are able to give them superior environmental advantages. Hence, when surveys disclose, as they always do, that the intelligence of a sample of children is correlated with the intelligence of their parents and their brothers and sisters, these correlations can be attributed to heredity, or environment, or both. To disentangle the influence of heredity from the influence of the environment, special procedures are required.

The most clear-cut evidence comes from comparisons of identical twins. Identical twins have identical heredity, since they come from the same egg, and therefore always look alike and are of the same sex. When one twin ranks high on an intelligence test, the other twin usually ranks high also, and when one is low the other is usually low. The correlation between twins is about .90.⁹ Since they usually grow up in the same family, this high correlation is due to both identical heredity and very similar environments. The correlation coefficient is not 1.00 because the tests are not perfectly reliable and the environments are not identical. More interesting are the less common cases of identical twins who are separated shortly after birth and brought up in different environments by relatives or foster parents. Typically if one twin has environmental advantages, the other does also, because social agencies try to place children in families like their own families. If both twins can be found later in life and lured into the psychological clinic for an intelligence test, their scores are similar. The correlation is about .80.^{9,10} The difference between .90 and .80 is attributed to the environment because we assume that the environments of separated twins differ more than the environments of twins who remain in the same home.

Smaller correlations, and larger differences in IQ, are found when the environments of the separated twins are known to be very different. In an unusual case one twin with only two years of schooling got an IQ of 92 while the other, who had gone to college, made 116.⁹ This large difference of 24 IQ points could not be due to heredity, because the twins were identical in this respect, and it is too large to be due to errors in the test. In general,

studies of identical twins separated early in life have demonstrated correlations that must be due to heredity and differences that must be due to the environment. Small environmental differences produce small IQ differences; large environmental differences produce larger IQ differences.

Twins of identical heredity who have grown up in different environments are hard to find, but adopted children, taken from their true parents and raised in a foster home, offer another possibility for disentangling the effects of heredity and environment. The child's heredity is estimated from an intelligence test given to the mother, if possible, or from the mother's education and the father's education and occupation, if known. The environmental advantages are estimated from the foster parents' education and occupation, but, as a matter of policy, social agencies give foster children only to parents who are judged to be well adjusted, interested in children, and able to provide for them.

The studies of foster children yield the same general picture of the effects of heredity and environment as the twin studies. The importance of heredity shows up in the fact that even after several years in foster homes the children's IQ's correlate higher with estimated intelligence of their true parents than of their foster parents. In one study of a hundred foster children the intelligence of the foster children correlated .32 with the education of their true mothers and .02 with the education of their foster mothers, with whom they had been living for 10 years.¹¹ The effects of the environment show up in the general increase in intelligence of the children in the foster homes over what would be predicted from their true parents' intelligence. The true fathers and mothers of these children had about 10 years of education on the average, and the 63 mothers who took intelligence tests got an average IQ of 86. One would predict that the children's average IQ would be about the same, but after 10 years or more in these superior foster homes where the average educational level was over 12 years, their average IQ was 106. The IQ gain of 20 points is too large to be attributed to errors of testing. Apparently the superior environments improved IQ's in general even though they were still correlated with true parents' education.

Investigations like these have shown the contribution of heredity and the contribution of the environment to the range of intelligence that we see around us. Or, to say it another way, the ability tested by intelligence tests is partly a hereditary ability and partly an environmental achievement. The relative contribution of each has not been determined with any precision, but most of the research to date allots somewhat more weight to heredity—at least for scores obtained from individual tests of general intelligence, such as the Stanford-Binet. These are general statements, of course, that do not say much about the genetic mechanisms, or how the environmental influences operate.

Specific Genetic Effects. There are a few cases in which the hereditary influences can be specified in more detail. Two rare kinds of mental defect, juvenile amaurotic idiocy, associated with blindness, and phenylpyruvic idiocy, associated with metabolic disorder, both follow the principles of simple recessive inheritance.¹² Some forms of color blindness are inherited through the female but manifested only in the male. Ability to taste a bitter chemical, phenylthiourea, is lacking in about 31 percent of the population (see Fig. 4.16), and this defect is due to a few simple hereditary units.

Specific Environmental Effects. Some cases of mental defect are due to inadequacies of the intra-uterine environment and some are due to birth injuries. The mother's diet also can influence her children's intelligence. Pregnant and nursing mothers in low-income families in Norfolk, Virginia, were given vitamin pills to supplement their inadequate diets, and when their children reached ages three and four, they were more intelligent than children of comparable mothers who had received dummy pills.¹³ Vitamins will not produce any improvement, to be sure, if the mothers are getting an adequate diet.

Coaching a child on the problems of an intelligence test may produce an increase in test score, but this is an artificial increase that does not last long. More permanent, of course, is the regular influence of education at home and in school. But the environmental effect which is most dramatically observed in a single individual is that associated with psychological maladjustment. A child may be referred to a psychological clinic with a record of failure in school and difficulty in getting along with other children. In the clinic he is given an intelligence test and gets an IQ of perhaps 85. Other tests indicate that he is not performing as well as he might, so the psychologist notes in his report that the child's adjustment might be improved by psychological therapy. If all goes well and the psychotherapy is effective, the child's adjustment improves, he does better in school, and, if tested again a year later, his IQ may be 105. Some of this improvement may be attributed to the unreliability of the first test, but some of it can also be attributed to a more general improvement in his intellectual functioning.

PRACTICE PROBLEMS

41. What is the best reason for discussing sensory abilities in Chapter 4 rather than in this chapter?
 - a. They are tested by individual rather than group tests.
 - b. They are not scored on a percentile scale.
 - c. They are not correlated with intellectual abilities.
 - d. Reliability of the scores is too low.
42. Guess the correlation between scores on an intelligence test and scores on a test of visual acuity in a sample of college students: (a) .00; (b) $-.15$; (c) $.25$; (d) $.45$; (e) $.70$.

43. Which of these perceptual skills would be most closely correlated with general intelligence? (a) Estimating lengths; (b) comparing colors; (c) estimating weights; (d) comparing visual patterns.
44. Mr. A said that since musical children usually have musical parents and musical grandparents, musical ability must be inherited. Mr. B said that since Republican children usually have Republican parents and Republican grandparents political attitudes are inherited. What is the source of the confusion?
 - a. Genealogies include both genetic and environmental influences.
 - b. Political attitudes have to be learned by experience.
 - c. Musical ability requires many years of serious practice.
 - d. Records of musical ability and political attitude are not dependable.
45. Which of these is the best definition of *ability*?
 - a. Innate capacity to solve problems.
 - b. The best one can do under average conditions.
 - c. Maximal accomplishment in a standard situation.
 - d. Average performance in all situations.
46. If the dream of democracy comes true and every child has equal educational opportunity, will this event increase or decrease the contribution of heredity to individual differences in intelligence?
47. When soldiers of World War II were given an intelligence test, their educational records were also available.¹⁴ Guess the correlation between intelligence and amount of education.
48. Adult men who enter a psychiatric hospital with serious behavior disorders usually get low scores on intelligence tests but as a rule there is no record of pre-psychotic intelligence. How could you estimate pre-psychotic intelligence for research purposes?

DISTRIBUTION OF ABILITIES

Now that we know how tests are constructed and scored, we can look at some of the results of years of psychological testing. Differences between the abilities of men and women, young and old, rich and poor have important consequences for the solution of social, economic, military, and educational problems. Information about the distribution of abilities aids practical decisions and also tells us about the structure of our society and where any particular individual fits into it. There are two questions for each comparison: (1) What are the differences? (2) What are the causes of the differences? The second question is much harder to answer than the first.

In general, when a large number of people are tested with a psychological test, we get a range of scores, with most people in the middle of the range, a few very high, and a few very low. When the scores are graphed, we see a frequency curve high in the middle and low at each end, as in Fig. 11.5. The same distribution occurs in Fig. 4.17 for hearing ability. This type of distribution, called a *normal distribution*, is the most common. It occurs when the scores are the results of many independent variables, such as hereditary units, environmental influences, motivational variations, and test-

ing errors. If the variations in the scores are due mainly to just a few factors, such as genes (see Figs. 4.16 and 4.19) or social roles (see Fig. 7.22), the distribution shows two or more peaks. This suggests that there are different types of people in the distribution, and further investigation may show that they are genetic types, or social types.

Another general trend to watch for in comparisons of groups is the *overlapping* of the scores. Nearly always, when we find that the average score of one group is higher than the average of another, the scores of the two groups overlap considerably. Some individuals of the high group fall below the average of the low group. To compare the groups clearly we need to know the amount of overlapping as well as the difference in the two averages. Naturally, we cannot speak of two types of people unless the overlap of their scores is small.

A persistent problem in studying the distribution of abilities is the sampling problem, and the principles of sampling, sketched briefly in the preceding chapter, apply here as well. The data of Table 11.6 were obtained from a representative sample of the voting adults of the United States, and the data of Fig. 11.5 were obtained from a representative sample of native white children, so inferences can be made from these samples to the populations thus defined. It is also enlightening to test more narrowly defined groups, such as women drivers, Hopi Indians, college freshmen, sword swallows, and unskilled workers, but one cannot make any statements about women drivers in general unless he tests a representative sample of women drivers. It is interesting to discover that college women do better than college men on some tests, but we cannot generalize to other men and women unless we repeat the tests with representative samples of the other men and women.

Age and Ability

Several tests have been constructed for infants, with limited success. The items are mostly sensory and motor tasks, which do not require the same abilities as the verbal, numerical, and abstract tasks used for older children and adults. Hence scores obtained by testing infants before age three do not agree very well with scores obtained by retesting them with a standard test of general intelligence at age six.

School Age. During the growing period there are large increases in intellectual ability from year to year. Equally important, there is considerable variation of ability within any age group, so one age group overlaps the next. This overlapping, along with the increase in average ability, is displayed in Fig. 11.11, based on statistics obtained when the Stanford-Binet Scale was revised by Terman and Merrill in 1937.¹⁵ The median, that is,

the 50th percentile, for the eight-year group represents about the same performance as a percentile score of 25 for the nine-year group. Or, to say it differently, 75 percent of the children of nine are above the average of children of eight. About 75 percent of the tens are above the average of the nines. But 5 percent of the nines are below the 95th percentile of the sixes. Graphs for other abilities and for intelligence in general always show about

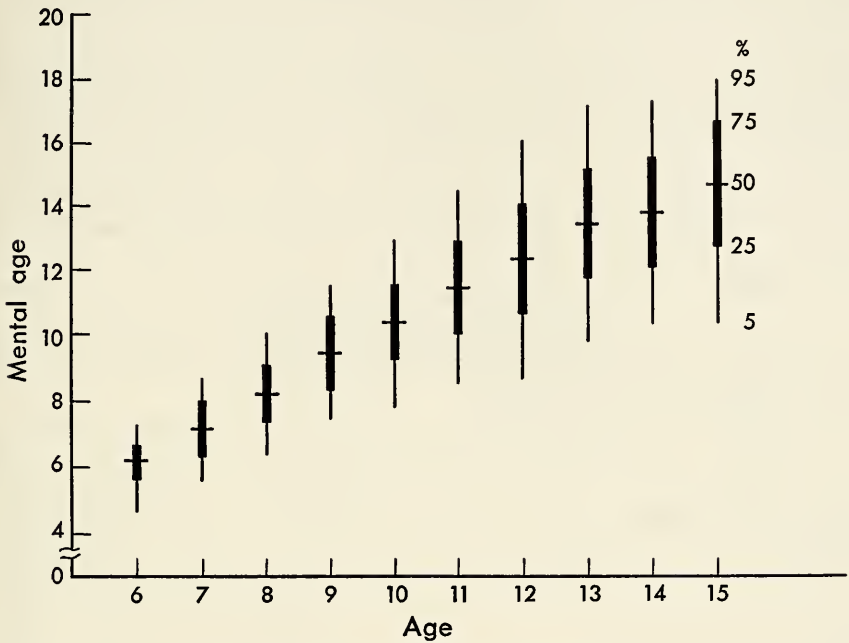


Fig. 11.11. Age and intelligence during the school years. A hundred to two hundred boys and girls at each age were tested for the standardization of the Terman-Merrill Revision of the Stanford-Binet Scale. At each age the horizontal bar shows the average score or 50th percentile. The heavy vertical column shows the range of the middle half of the children, from the 25th percentile to the 75th percentile. The thin vertical line shows the range from the 5th to the 95th percentile. For example, the average mental age of these children of seven was 7.2. The middle half of this age group scored between 6.4 and 8.0, and the middle 90 percent between 5.6 and 8.8. The average at age eight is substantially above the average at seven, but the overlap is large, for almost 25 percent of the eights were below the average of the sevens. (Drawn from means and SD's in McNemar¹⁵)

the same picture of overlapping between groups along with a regular increase in average ability during the growing years.

The data for Fig. 11.11 and similar comparisons were obtained from cross sections of different age groups all tested at about the same time. This *cross-section method* gives us important information about the distribution of abilities but does not tell us whether the children who are below average this year will still be below average next year. To answer such questions a *longitudinal method* is necessary: the same children must be tested re-

peatedly. When this is done, we see regular increases from year to year in average scores, with considerable overlapping—much like the cross-section graph of Fig. 11.11—but we can also follow the development of each individual child. See Fig. 11.12 for the development of one girl from 3 to 14.¹⁶

Longitudinal investigations are expensive and slow. To follow children from 6 to 16 takes 10 years. But several such investigations were started many years ago and are beginning to produce important scientific results. We know that intelligence develops, by and large, in a predictable way. In one study of 40 superior children in California intelligence at age 6 correlated .86 with intelligence at age 7. Intelligence at 10 correlated .92 with intelligence at 11. But over a longer period of time the fluctuations are larger and the correlations are smaller. Intelligence at 18 could be predicted from intelligence at 13 with a correlation of .93, but the prediction from 6 to 18 gave a correlation of only .77.¹⁷ Intelligence should not be considered a fixed characteristic of the individual which can be measured once for all time. And yet, with all the errors and fluctuations considered, it is still possible to test children at age 6 and predict their intelligence 10 years ahead with an average error of less than 20 percent. That is better than the weatherman can do, predicting 10 days ahead.

Correlation coefficients summarize the accuracy of predictions from one year to later years, but they do not tell us the size of the changes in individual children. This is a particularly important question for below-average children and their parents. If a child has a low IQ today, will he have a low IQ next year? To answer this question 70 elementary school children

who got IQ's between 46 and 90 were tested again a year or two later. The average IQ increased slightly, from 76.9 to 77.4, but the individual children shifted in both directions.¹⁸ As Table 11.8 shows, half of the children

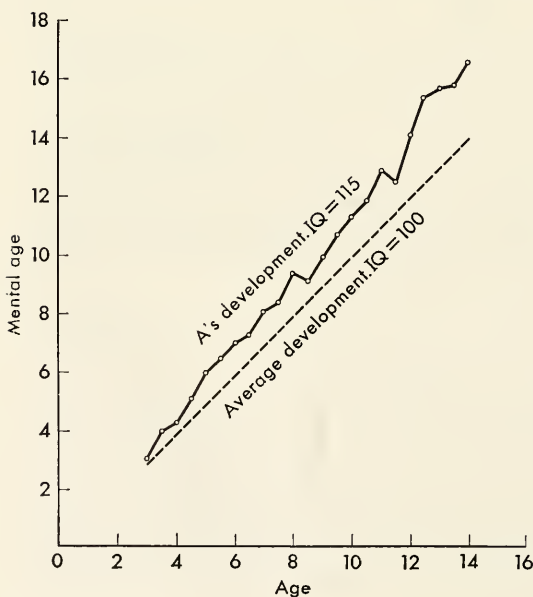


Fig. 11.12. Intellectual development of one individual in a fairly constant environment. This girl was tested regularly from 3 to 14. At 3 her mental age was 3 years, 2 months; so her IQ was 106. Six months later her IQ was 114. The average of the 23 IQ's is 115. Her intellectual development, as shown by the heavy line, may be compared with average intellectual development, as shown by the broken line. (Data from Wallin¹⁶)

shifted no more than 5 IQ points, but half shifted more than 5 points, and two shifted more than 20 points. Such large shifts are not common in below-average children, but they do occur, more frequently when the interval between testing is longer. A shift of 20 points upward could move a child from an IQ of 90 to one of 110. That is why psychologists test children more than once before making any important decisions.

Longitudinal studies of superior children show even larger fluctuations in IQ. They shift most around three, four, and five, when the tests are shifting from sensorimotor tasks to intellectual tasks. One group of superior children in Ohio showed IQ changes averaging 4.2 points between 3 and 4 but only 1.7 between 11 and 12. In this group 62 percent of the children shifted more than 15 IQ points up or down sometime between 3 and 10. The children who were rated high on competitiveness, initiative, and aggressiveness at age 6 were the ones who gained the most in IQ during the school years.¹⁹

TABLE 11.8. IQ Changes for 70 Young Children Tested with WISC at Intervals Averaging 17 Months

Size of Change in IQ	Number of Children
20-25	2
16-20	5
11-15	10
6-10	18
0-5	35

SOURCE: Whatley & Plant.¹⁸

Adults. When the Wechsler Adult Intelligence Scale was standardized, representative samples of subjects in several age brackets were tested, and Fig. 11.13 shows the differences in averages and the overlapping between age groups. The older subjects got lower scores, hence, to make average IQ equal 100 at all ages, separate norms were constructed for each age bracket.

Fig. 11.13 gives a good picture of the distribution of adult intelligence in the United States. But these data were obtained by the cross-section method around 1953, and anyone who was 70 at that time was born in 1883 and received most of his education during the last century when educational opportunities were not as widespread as they are today. Hence we do not know how much of the difference between these age groups is due to age changes and how much is due to educational changes in the culture. This question can be partly answered by the longitudinal method.

In 1919 the freshman class of Iowa State College took a group intelligence test and in 1950, 127 of these men, who were then about 50 were found and persuaded to take the same test again. This is a 31-year interval, but the

1919 scores correlated .77 with the 1950 scores. More important, instead of a decrease, there was a substantial increase in the average score. Nineteen of the men had taken an intelligence test in the interval, but they did not gain any more than the others. The ones who gained most were those who had continued their education longest.²⁰

Other follow-up studies with superior men and women have shown similar increases,²¹ so we must conclude, at least for those who go to college and continue to live an intellectually stimulating life, that general ability does not decline much, if at all, before age 50. Those who are identified as retarded when young seem to develop slowly up to age 30 or so, and they also

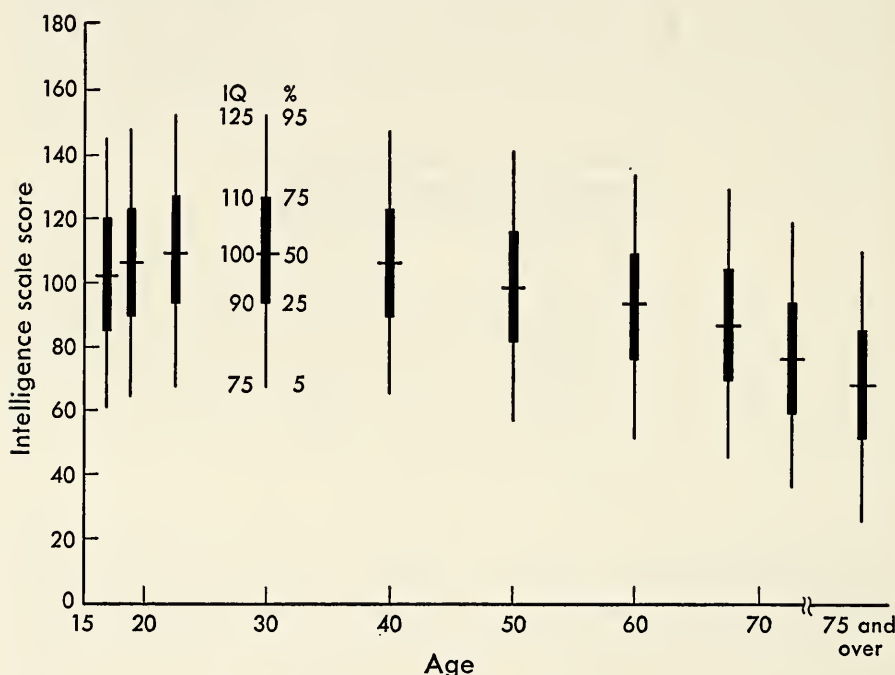


Fig. 11.13. Age and intelligence during the adult years. In each age group 100 to 300 men and women were tested for the standardization of the Wechsler Adult Intelligence Scale. The older people score lower but there is considerable overlapping. The norms of the WAIS are arranged so that the 5th percentile in each age group is equivalent to an IQ of 75, the 25th percentile 90, the 50th percentile or average 100, the 75th percentile 110, and the 95th percentile 125. (Data from Wechsler⁴)

do not decline until about 50. The severely retarded gain only slightly during the teens and not beyond.²²

Differential Effects of Age. Abilities are not all affected by age in the same way. Older people are handicapped on speed tests, especially those that require new performances under time stress. Some of the tasks on intelligence tests demand rapid performance in manipulation of blocks to make a de-

sign, rearrangement of pictures in sequence, and clerical work with digits and symbols, and Fig. 11.14 shows that it is on such performance tests that the older people make their lowest scores. But on tasks that require an ac-

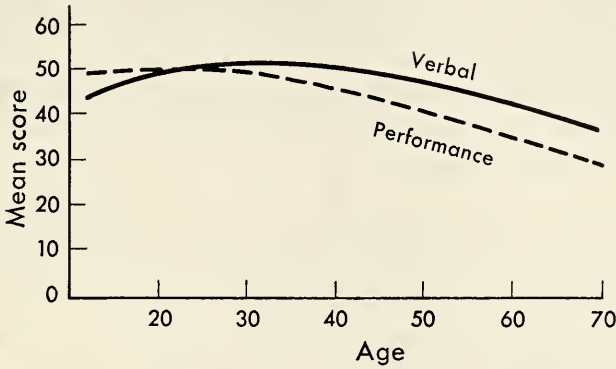


Fig. 11.14. Age differences on verbal and performance tests of the Wechsler Adult Intelligence Scale. (From Wechsler⁴)

cumulation of experience, like tests of information, vocabulary, and comprehension, the older people are only slightly below the younger in cross-section comparisons. And it is these verbal tests that are chiefly responsible for the gains noted in longitudinal comparisons.

Group Differences

One of the most popular spare-time activities of human beings is talking about other human beings. Before psychological tests were invented, the only comparisons that could be made were made on the basis of personal experience, every man for himself. Such an impressionistic method enables anyone to stack the cards in favor of his prejudices or his employment policies by selecting extreme cases. The correct method, of course, is to compare representative samples of each group on objective tests.

Sex Differences. Comparing boys and girls, or men and women, in general intelligence no one has found a difference of any significance, but when the sexes are compared on differential abilities, small differences in averages emerge, along with considerable overlapping between the groups. At all ages the average male is somewhat better on arithmetic skills and arithmetic reasoning. At all ages the female of the species is somewhat better on verbal skills, such as word knowledge, spelling, and grammar, but the males are usually superior on reasoning and solving difficult problems, even when the problems involve verbal concepts.

As to the various mechanical abilities, men are superior in mechanical information and reasoning ("What is the thing to do when the doorbell won't

ring?”), but the sexes are equal in dexterity with the hands—except for the use of heavy tools. Women are better on tests of clerical ability that require checking letters and numbers and perceiving similarities and differences rapidly. The male superiority in mechanical information is probably due to social expectations and opportunities, but the reasons for the other sex differences are not known.

When the difference between sexes is appreciable, separate norms are constructed. Fig. 11.15 shows the percentile score of the average girl on the

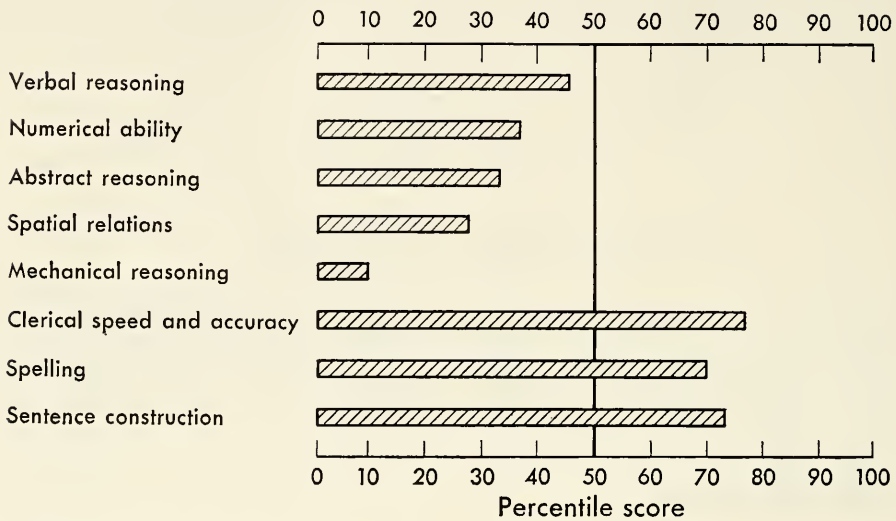


Fig. 11.15. Sex differences in eight abilities. Girls' average scores in Grade 12 are plotted on the boys' norms in order to show sex differences. What is the average boy's percentile score on the Spelling test? on the Mechanical Reasoning test? (Data from Bennett, Seashore, & Wesman⁷)

boys' norms of the Differential Aptitude Tests when they were given to over 2000 of each sex in Grade XII in United States schools. (To understand this graph you must know the percentile score of the average boy on each test.)

Urban-Rural Differences. For many years city people in the United States, both children and adults, have done better on intelligence tests than country people. The urban-rural difference is larger for verbal abilities than for mechanical abilities, and it is larger in high school than in elementary school. This urban-rural difference has been found in several European countries also, and in all comparisons the inferiority of the rural schools and the lack of intellectual stimulation in rural life seem to be the chief causes. In Scotland, where the rural schools are good and rural life has high prestige, the urban-rural difference is not consistently found.

Changes are taking place in the United States. One massive change is the growth of the suburbs, between city and country. But suburban life is closer

intellectually to urban life than to rural life, so it is not surprising that suburban children resemble city children more than they resemble rural children. When the Stanford-Binet test was standardized on large representative samples around 1935, the average urban IQ between 6 and 14 was 106, suburban 105, rural 95.¹⁵ However, intellectual opportunities in many rural communities in the United States are being up-graded through better schools, better transportation, rural electrification, television, and traveling libraries. On the other side, large areas in many metropolitan cities are deteriorating. Hence urban-rural differences may be shifting at the present time.

Socioeconomic Differences. Sex differences and urban-rural differences are small, but differences between occupational classes are large. When enlisted men of the U.S. Air Force in World War II were tested on the Army General Classification Test, it was possible to group their scores according to their civilian occupations and compute averages for the men in many common occupations.²³ Distributions of general ability in three common occupations are shown in Fig. 11.16. Distributions of scores for most other occupations

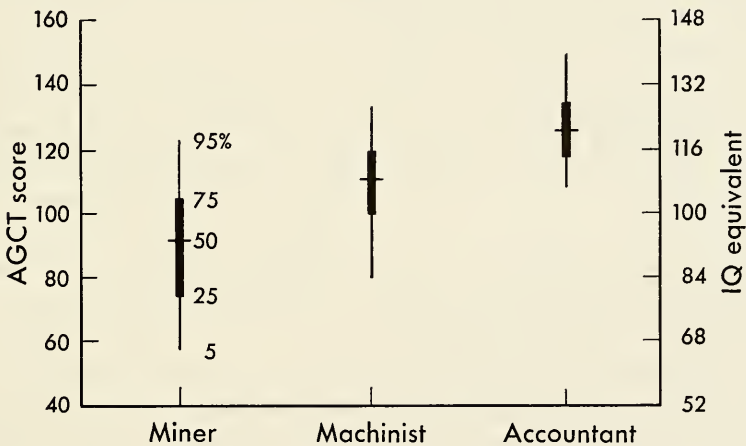


Fig. 11.16. Occupation and intelligence. Scores of Air Force men on the Army General Classification Test were grouped according to their civilian occupations. The scale at the right gives an approximate IQ. (Data from Harrell & Harrell²³)

fell between the miners and the accountants, but the highest occupational levels were not well represented among the enlisted men. The IQ scale on the right of Fig. 11.16 is not obtained by dividing MA by CA, of course; it is the deviation IQ used for adults.

It is possible also to group occupations into a few broad classes, similar to those used in the preceding chapter, and compute averages in terms of adult IQ's,²⁴ as shown in Table 11.9. When the Stanford-Binet test was revised, children were grouped according to their fathers' occupations, and

these averages are also set down in Table 11.9 for comparison. From such statistics, obtained from large-scale testing in many industrialized countries, it is clear that there are definite differences in average intelligence

TABLE 11.9. IQ Levels for Adults and Children Classified in Seven Occupational Groups

	Adults	Children
Professional	120	116
Semiprofessional and managerial	113	112
Clerical, skilled trades, retail business	108	107
Rural owners, farmers	94	95
Semiskilled, minor clerical, minor business	104	105
Slightly skilled	96	98
Day laborers, rural and urban	95	96

SOURCE: Johnson.²⁴

among people working in different occupations and that these differences apply to their children also. Furthermore, we know, from tests of U.S. troops in World War I, that occupational differences have been a characteristic of our society for half a century at least.

Cities and towns in the United States vary in intellectual level as well as socioeconomic level. When the children in 154 communities were tested by a group intelligence test, the high average scores came from those communities in which the adults had high average income, high percentage of home ownership, and high percentage of professional occupations.²⁵ When the 48 states were compared, average intelligence correlated .81 with average income and .80 with amount spent per pupil on education.²⁶ Thus, in this automated age, while some states are attempting to attract new factories by advertising cheap water power and low taxes, others, e.g., Minnesota, are advertising the intelligence test scores of their citizens.²⁷

Ethnic Comparisons. Intelligence tests are a product of Western European culture, like automobiles and nuclear fall-out, but since they have been so useful for comparing groups within this culture, they have also been used for comparing groups of different cultures. Such comparisons are likely to be biased in several ways, basically by the circumstance that the tests are most favorable for people who are most similar to the people by whom and for whom the tests were constructed. The case of the American Indian illustrates some of the problems and the results.

When the paleface came to North America, there were many tribes of Indians, some quite primitive, some in an advanced stage of culture. Over the years some of these have accepted much of the conqueror's culture, while others have stubbornly retained their own culture and independence. Today, when they are tested by the white man's tests, the average score for

most tribes is low, though some tribes do better than others, and some are above the white man's norms on performance tests.²⁸ These differences can be attributed, of course, to environmental differences—that is, to differences in acquisition of the Western European culture—and to genetic differences.

To weigh the relative importance of heredity and environment in this case is very difficult. The ideal method would be to find 20 pairs of identical Indian twins and allow one of each pair to remain with his family and give the other all the advantages of Western European culture. This kind of controlled experiment is not feasible, but the discovery of oil years ago on the land of the Osage Indians of Oklahoma did lead to environmental changes that are very instructive. Today, because of their royalties from the mineral rights of Osage County, these Indians are equal in economic and social status to their Caucasian neighbors. Furthermore, nearly everyone in the tribe speaks English. When intelligence tests were given to most of the children in Osage County, the average IQ for the Indian children was 100, the same as the average for the white children in these schools.²⁹ Unfortunately we have no records of the intelligence of these Indians before they struck oil, but the most reasonable interpretation of the evidence at hand is that the oil money equalized environmental opportunities for two generations and thus made it possible and attractive for the Indians to acquire the white man's culture and to reach the norms on the white man's test. Perhaps other Indian tribes could reach the white man's norms if their progress were lubricated by oil in the same way. This does not prove that there are no genetic differences between Indians and Caucasians, but it means that there are other good ways of explaining the differences that are observed.

The case of Negroes in the United States is slightly different. They do not have a culture and a land of their own to cling to, but they have not been allowed, as a rule, to participate fully in the culture of the dominant whites and have not had equal opportunities for education. At present, when large groups of Negroes in the South are tested, they score below the white average. In the North, where environmental opportunities are better, but still not equal to those of whites, Negroes score higher, but still not equal to the whites. There is considerable overlapping between the groups, to be sure; well-educated Northern Negroes score higher than poorly educated Southern whites. As educational and occupational opportunities for Negroes improve, they will be able to provide better intellectual environments for their children, so each generation will come closer to the white norms. In Grand Cayman, an island dependency of Jamaica, where environmental advantages at present seem to be almost equal for white and colored, the colored do almost as well as the whites on intelligence tests.³⁰ Questions about genetic differences between Negroes and whites in capacity for intellectual

development cannot be clearly answered until environmental opportunities have been equalized for two or three generations—at which time such questions will not seem important.

When attempts are made to test intelligence in cultures very different from the Western European culture, as in many parts of Africa, the inadequacies of tests constructed for our culture become apparent, and new testing procedures fairer to the natives are being sought. This does not mean that the present tests are worthless. They measure the extent to which the natives have absorbed the European language and culture and are thus useful in selecting natives for employment in a European organization.

Basic Factors in the Distribution of Abilities

The foregoing facts about abilities are interesting in themselves; in addition, they lead to some generalizations about the development and utilization of abilities in our technological society. Unfortunately, none of this evidence comes from controlled experiments. When we find, for example, that intelligence is closely related to education, we have to be critical about inferring which is cause and which is effect.

Maturation. Comparing children and adults clearly shows that maturation is one important factor in intellectual development. Differences due to environmental opportunities seem rather small compared to differences between a child of 2 and a child of 10 in any environment. Hence, to predict a person's abilities in the first two decades of life the most useful single fact to know would be his age.

Individual differences in any age bracket during this growing period are due in part to differences in rate of maturation—as implied in the old concept of IQ as MA/CA. Differences in rate of maturation can also account for the correlation between intelligence at 5 and at 15 if we assume that those who mature rapidly during the first 5 years mature rapidly during the next 10 years.

Aging, the down side of maturation, reduces speed of performance in all environments.

Accumulation of Learning. The increase in ability from year to year depends not only on maturation but also on the accumulation of information, concepts, problem-solving skills, habits of attending, and other achievements that can be transferred to new situations. The girl who has learned 20,000 words by age 10 does not have to learn them again; she can devote her abilities to learning more words and more abstract concepts. If she is above average in these things when she enters high school, she is likely to be above average when she leaves high school, even if she matures at only the average rate. And after maturation is complete, some abilities continue to increase,

especially information, comprehension, and good judgment. This factor also can account for part of the stability of IQ's from one year to another because any one year's gain is built on the achievements of previous years.

Education. In representative samples of adults in the United States intelligence test scores and number of years of education correlate about .70.¹⁴ One could make a rough estimate of the intelligence of an adult simply by asking how far he went in school. This high correlation is due to two tendencies, working together. First, the less intelligent tend to drop out of school early, when they hit the hard subjects. Second, education increases intelligence. After school, the more intelligent men with better education move into the higher occupations, pursue a more intellectual life, and continue to increase in intelligence. Thus the age at which intellectual development slows down depends on education as well as maturation. Those of less intelligence and education do not increase much in intelligence after 20; hence in middle age there is a big spread between the bottom and the top of the distribution. Education combined with job training makes people more different, not more alike.

The same principles apply to women who work. And these principles apply also to women who do not work, for women tend to marry men like themselves in intelligence and education.

Economic Status. Education and intelligence are *effects* of economic status. People in the higher economic brackets have more education on the average, place a higher value on intellectual goals, expect their children to get more education, and give them more help at home and in school than do those in the lower economic brackets. They are more intelligent themselves on the average and give their children genetic advantages at the start.

Education and intelligence are *causes* of economic status also. As a rule, occupations of high economic status demand more intelligence and education than those of low status. Since the top jobs are more attractive in money, prestige, power, and intellectual interest, bright young men and women with high motivation for achievement strive to get the educational requirements and move into the higher occupational levels. These interacting cause-and-effect relationships account for the stability of the occupational differentials in intelligence shown in Table 11.9.

Occupational levels in the United States are stable but not rigid. It is true that well-to-do executives, financiers, and professional men can give their children a better start in life than parents of middle and low incomes. But the number of parents in the top-level occupations is so small that a large percentage of the top jobs must be filled by the offspring of middle-income parents. Furthermore, there is considerable overlapping between economic classes in education, intelligence, achievement motivation, and values. Education in particular is often seized by lower-class boys and girls

as an opportunity for social mobility, a chance to move upward. On the other side, the pressures for achievement put on boys and girls by middle-class and upper-class parents may be too severe, and the reaction may, in effect, reduce their abilities.

PRACTICE PROBLEMS

49. Which of these statements about preschool intellectual development is most accurate?
 - a. Before age five children do not gain much in ability.
 - b. The gain before five is not the same kind as the gain after five.
 - c. Before age five children's abilities cannot be tested reliably.
 - d. Before age five age scales are not applicable.
50. From Fig. 11.11 compute the IQ of a girl of 10 who is at the 95th percentile of her age group.
51. What would be the percentile score for typical seven-year ability in reference to the norms for the eight-year group? the nine-year group?
52. At the higher occupational levels, which are more important, the abilities measured by verbal tests or those measured by performance tests?
53. What biological factor, suggested by research described under the heading "Heredity and Environment," could account for some of the superiority of the young in cross-section comparisons?
54. The correlation of .70 between intelligence and education proves the influence of (a) heredity; (b) environment; (c) neither.

PSYCHOLOGICAL ABILITIES AND SUCCESS IN LIFE

Psychologists began to study intelligence because it is an important ingredient of success and failure. They invented tests and scoring schemes, studied the correlations between scores, tested and retested many people, and arrived at a better understanding of such psychological constructs as general intelligence and differential abilities. With this modern knowledge, the essentials of which have been outlined in this chapter, we are now in a position to return to the practical question of the relation between abilities and success in a competitive world.

Intellectual Deficiency

People with IQ's below 70 are usually considered feeble-minded or *mentally deficient*. From 70 down to 50 they are called *morons*, from 50 to 20 *imbeciles*, and below 20 *idiots*—or the defect is simply classed as mild, moderate, and severe. The names are not important, of course; in fact the IQ ranges attached to these names vary somewhat in different countries with different tests. In practice the decision to commit a person to an institution for the mentally defective or to give him special training is made on the

basis of social adjustment, emotional control, job possibilities, and health, as well as IQ.

Intellectual deficiency is due in part to the same multiplicity of causes, genetic and environmental, that are responsible for the normal range of intelligence. From the normal distribution of IQ's, graphed in Fig. 11.5, one would expect about 3 percent below 70, about 1 percent below 60, and a very small fraction below 50. Actually the percentage below 50 is larger than would be expected from normal variation, and the surplus is presumed to be due to special pathological factors. In addition to the pathological genetic factors mentioned earlier, nutritional and endocrine deficiencies in the prenatal environment and difficulties at birth have been identified as important factors.

Everyone knows that mental defectives are handicapped in life, and most states have programs for their care, administered by psychologically trained personnel. Few adults with IQ below 50 are able to support themselves, and those with IQ below 30 are dependent on others for protection from common dangers. In the IQ range between 50 and 70 some manage to get along quite well, especially if they are not irritable and can hold a job. When these borderline cases are given special training adapted to their abilities and to the requirements of the available jobs, many can become useful to themselves and to society. Several training schools for the mentally deficient have accumulated encouraging statistics on the occupational adjustment of their alumni.

Intellectual Superiority

What about those at the other end of the scale of achievement, those geniuses who have left their names on the pages of history? Were they superior in intelligence? Records of intellectual development in childhood are available for some eminent men and can be used in an indirect way to estimate intelligence on our modern IQ scale. We know, for example, that the average child learns to read at seven or eight, so we can assume that a mental age of six is necessary for this accomplishment. We also know that John Stuart Mill was reading at age three, so we can divide MA by CA and get an IQ estimate of 200. A mental age of about 14 is necessary for algebra and he learned algebra at 8, so another IQ estimate would be 175. In Mill's case there are several such facts that permit several such estimates, the average of which is 190 for his childhood and 170 for his youth. The records of 300 eminent men and women have been evaluated in this way by three psychologists working independently, and in cases for which the records were adequate and the psychologists agreed, the average estimate can be taken as the minimum IQ that will account for the historical facts.³¹

According to such estimates all these great men had high IQ's. Goethe, who wrote poetry in Latin when he was eight, was scored 185 for his childhood and 200 for his youth. Others of interest: Pascal, the mathematician, 180; Voltaire, the French writer, 175; Mozart, the composer, 155; John Quincy Adams, the sixth president of the United States, 165. In general those who made their reputations as philosophers averaged 170, the poets, novelists, and dramatists 160, the scientists 155. The lowest were those who became famous as soldiers, with an average of 125. Most of these men were versatile thinkers, far above their fellow men in several lines of accomplishment, and their biographical records indicate strong motivation toward their intellectual goals in spite of frustration, often in spite of the opposition of family, friends, and social norms. No one believes that their creative genius rests on their intelligence alone.

Extreme intellectual superiority, like extreme intellectual inferiority, is due to the same multiplicity of factors, genetic and environmental, that are responsible for the normal range of intelligence. From the normal variation in IQ's, graphed in Fig. 11.5, one would expect about 3 percent above 130, about 1 percent above 140, and a very small fraction above 150. There is no evidence for any special pathological factor at the high end of the scale. The multiplicity of factors involved, whatever they may be, and the result-

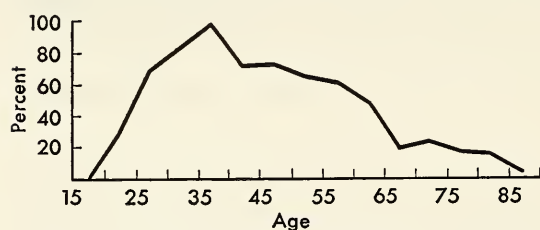


Fig. 11.17. Age and creative achievement. Study of 60 histories of art disclosed that 650 oil paintings were mentioned at least twice. The age of each artist when he painted each picture is also given by the histories. From these facts the above curve was drawn, showing that more of these masterpieces were painted when the artist was between 35 and 40 than in any other five-year period. Note also that an appreciable number of masterpieces were painted before 25 and after 70. The curve is adjusted for the fact that there were fewer artists living at the older age brackets. (From Lehman⁸³)

ing shape of the distribution curve guarantee that whenever several people can do anything extraordinarily well, there is a statistical probability that someone will come along who can do it better.

Age and Creative Achievement. Checking the historical records of great men and women turns up another important psychological fact: most of the creative thinkers did their best work when they were rather young. The

work of living artists and scientists cannot be accurately evaluated, but those who are mentioned in several histories of art, or science, must have done work of permanent value. Usually their ages are known, and detailed study of these facts has shown that the peak age for great poetry was between 25 and 30. The peaks for chemistry, physics, and practical inventions

fall between 30 and 35. Great achievements in mathematics, psychology, and philosophy as well as masterpieces of painting and short-story writing come most often between 35 and 40.³² Figs. 11.17 and 11.18 indicate the frequency of great work in two fields, and from Fig. 11.18 it is apparent that the quality of a philosopher's output usually falls off faster than the quantity.^{33,34} This is the case in other fields as well. In fact much of the work done by great thinkers in their later years is an elaboration of the brilliant ideas of their 30's. The elderly gentlemen in the fading portraits on library walls were not painted while they were achieving fame but after they had it made.

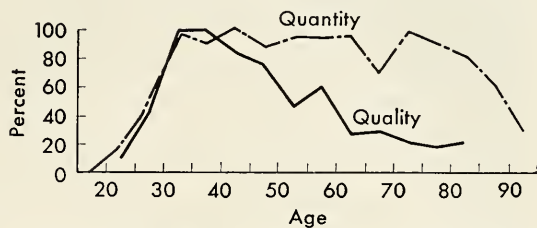


Fig. 11.18. Quantity and quality of creative output at different ages. The solid line shows the ages at which 182 famous philosophers wrote (or first published) their one best treatise, i.e., the one most frequently mentioned in the histories of philosophy. The broken line was constructed by tabulating the ages at which all the philosophical works of these 182 philosophers were written (or first published). (From Lehman & Gamertsfelder³⁴)

What Becomes of Superior Children? Starting with eminent names and working backward to childhood is one way of tracing the relation between superior intelligence and worldly success. The other way is to start with highly intelligent children and follow them forward. In 1922 about 1500 boys and girls with IQ's of 140 and higher were identified in California schools and studied for the next 35 years.³⁵ Would these bright children, averaging 152 in IQ at age 10, actually fulfill the promise of their youth? Or would they, in accordance with the folklore of the day, become misfits, unable to adjust to this imperfect world?

Educationally they did very well. About 70 percent were graduated from college, and the percentage who took advanced degrees was much larger than the corresponding percentage in the general population. At the last follow-up, average IQ, estimated from adult norms for adult tests, was 135. This drop of 17 IQ points is about what one would expect from the correlations over long intervals mentioned earlier. Actual scores on a high-level test of abstract thinking were higher at 45 than at earlier ages. Occupationally, the men did very well also. About 45 percent were in professional occupations, as compared with 6 percent of California men in general. About 26 percent were in semiprofessional and higher business occupations, as compared with 8 percent for the general population. Records of books, poems, patents, and the like show that, taken as a group, their literary, musical, scientific, and financial achievements were far above average. There

were also a few men in semiskilled and minor clerical jobs. A few of the women have distinguished themselves in poetry and science, but most of those employed were in secretarial work and teaching.

About 84 percent of this gifted group were married at last report and had the usual number of children. The average IQ of their children was 128. The marriage rate for the women was the same as the rate for California women in general, which is above the rate for college women in general. The death rate, delinquency rate, and amount of illness were somewhat below average. Mental health and marital adjustment, as far as these could be judged, were better than average. Beyond doubt, these people in middle age have done very well according to all criteria, and other superior groups that have been followed have also done well, but we must not consider their high IQ the only factor. When they were young 30 percent of their fathers were professional men and 50 percent were in semiprofessional and higher business occupations. They started life with the family advantages associated with high intelligence.

The Normal Range of Human Ability

So much for the rare individuals at the extremes of the scale of intelligence. To get a more comprehensive picture of the relation between intelligence and success we should look at people along the whole range of intelligence and see how they solve the general run of human problems. In the first few years of life children are busy with sensory, motor, and social problems, success in which depends on physical characteristics, health, emotional adjustment, and parental encouragement as much as general intelligence. When they go to school and have to work with symbols, as in reading, writing, and arithmetic, general intelligence becomes more essential for their adjustment, and the score on an intelligence test predicts school success with fair accuracy. There is a definite relation between general intelligence and success in high school and college also. These correlations are not high, usually between .50 and .60, because, as every student knows from personal experience, success in college depends on other factors as well: courses taken, accuracy of grades, and personality factors such as achievement motivation, intellectual interests, and general adjustment to academic life. High school grades also predict college grades, with correlations from .40 to .50, because intellectual abilities remain fairly constant over this age range, because those who do well in high school are well prepared for college, and because the personality factors that are helpful in high school are helpful in college also. Hence the tests given to college freshmen to predict academic success may be tests of general intelligence, differential abilities, educational achievement, or various combinations of these.

The relation between intelligence and success after college has been demonstrated by comparing alumni records with college test records. In general it is clear that students with above-average scores have the edge on their below-average classmates when the facts are gathered 10 years later. The same relationship can be demonstrated between college grades and success after college because grades depend on intellectual abilities, motivation, social adjustment, and personality factors, all of which influence occupational success also. Intelligence contributes strongly to performance of an intellectual nature, as in professional, executive, and research jobs. Some occupations of high occupational status require a college degree, so those who do not have the ability to succeed in college simply do not enter such occupations. There are many jobs also which depend chiefly on social skills, such as selling jobs, or some special ability, such as tea tasting, and for these jobs intelligence is not a good predictor.

The ingredients of success are often combined in unusual ways, and general statements may be misleading. Many occupations, for example, require a certain minimum of one ability, but above this minimum success depends on other things. A mental age of nine is sufficient for simple assembling, packing, sewing, bottling, and cleaning, and for those above this level satisfactory performance depends on steadiness, resistance to distraction, and other personality factors. Selling a complicated product, such as insurance or agricultural machinery, requires enough intelligence to understand and explain the product, but above this minimum success depends on social abilities. A research chemist needs enough social ability to convince others that his work deserves support, but above this minimum success depends primarily on intellectual abilities. Social skills and other personality traits cannot be measured as accurately as intellectual abilities, but their measurement and influence will be considered in the next chapter.

The Selection and Placement of Personnel

The relation between psychological traits, such as intelligence, and success in life's struggles has great possibilities for employers. Because of this relation it is possible to give a test or a battery of tests to a number of applicants for a job and identify those most likely to do the job well. Or it may be possible to place each person in the job he does best. The procedure is simple in principle but often difficult in practice.

The first step is usually a *job analysis*, a study of the actual activities of people in this job and an estimate of the abilities involved, special skills, common errors, working conditions, hazards, and so on. Taking suggestions from this source and any others that seem promising, such as analyses of similar jobs, the psychologist constructs a selection program that attempts

to predict which applicants will succeed on the job and which will fail. The cost of the program must be considered at the beginning. An expensive testing program is not justified for low-level jobs for which little training is necessary. But many high-level jobs in modern business and industry require several months of training, and it may be a year before it is clear which employees are worth their salaries and which are making expensive mistakes. In such cases a testing program which costs three months' salary for each applicant and eliminates half the failures would be very profitable.

Many selection programs begin with an inexpensive group test of general intelligence because the scores give a rough classification of the applicant's suitability for many different jobs. Educational records may be similarly used as a first step because of the correlation between education and intelligence. But, since college graduates are scarcer and more expensive than high school graduates, some employers select high school graduates who score high on an intelligence test and give them an opportunity to compete with college graduates. Applicants who are classified above a certain minimum in intelligence or education are next given special tests to determine their suitability for more specific jobs. These may be tests of trade knowledge, perceptual or manual skill, emotional stability, or social adaptability, some of which are performance tests that can be given to only one person at a time by a trained examiner.

Some employee selection programs begin, not with a general classification test, but with tests of differential abilities. An applicant who scores high on clerical speed is recommended for one type of job, and an applicant who scores high on mechanical reasoning is recommended for another type.

Many selection programs collect information about an applicant's background. In the selection of men for sales jobs, for example, the man's personal history has been found to be particularly significant. A married man will usually sell more insurance than a single man. Such facts as reason for leaving the last job, number of dependents, monthly expenses, and club memberships have been found useful in selection of applicants for jobs that depend on social interaction.

Validity of Tests. The ultimate question, of course, is whether the testing devices work in actual practice. Do the test scores really predict future performance? The best way to answer this question is to test a hundred people, file their scores away in a safe place for a year, then later compare their performance with their test scores. In order to do this we must have a measure or *criterion* of performance, such as dollar value of insurance sold during the year, number of products completed, number of accidents, or perhaps an overall rating by a supervisor. A pass-fail criterion may be available if new employees go into a training course, and those who pass are put on the regular payroll while others are washed out. Actually, good criteria of job

success are hard to get, because different employees work at different jobs or under different working conditions. It is easier to sell insurance in some territories than in others. There are more accidents on some routes than others. Ratings may not be based solidly on job performance. Yet a reasonably accurate criterion of job success is necessary, because if success on the job cannot be measured with fair accuracy, it cannot be predicted a year in advance. Or, to turn the rule around, any inaccuracy in the criterion reduces the apparent validity of the test scores.

As a first example, let us consider prediction of academic success, since reasonably good criteria are available—in the form of college grades. The College Qualification Test, which includes subtests of verbal ability, numerical ability, and information, is widely used for guidance of college freshmen.⁸ In one large university, as a check on the validity of this test, grades for a sample of freshmen at the end of the first term were compared with the scores they had made on the CQT when they took orientation tests at entrance. One common statistic for this purpose is the correlation coefficient, which wraps up in one number the relation between the whole range of grades, from F to A, and the whole range of test scores. When used in this way such correlation coefficients are known as coefficients of *predictive validity* because they show how well the test scores predict future grades. Table 11.10 shows that the total score on the CQT predicts Grade Point

TABLE 11.10. Validity Coefficients for the College Qualification Test When Used to Predict First-Term Grades of 476 Men at a Large State University

	College Qualification Test			
	Verbal	Information	Numerical	Total
Natural Science	.47	.55	.55	.63
Communication Skills	.66	.51	.41	.66
Grade Point Average	.47	.49	.50	.59

SOURCE: Office of Evaluation Services, Michigan State Univer.

Average with a validity of .59, which is quite good when the inaccuracies of grading and the variations between courses are considered. The table also shows that grades in Communication Skills are predicted best by the verbal score and that grades in Natural Science are predicted best by the information and numerical scores.

After the first term, prediction of grades from tests taken at entrance is less accurate. It is easy to predict that students with very low test scores will get low grades, but after the first term many of these students have gone, so the prediction problem is more difficult and the validity coefficients are lower. It turns out that the grades in later terms can be predicted better from grades obtained the first term than from tests taken at entrance. For

example, in one large state university prediction of second-term grades from CQT was about .45, while prediction of these grades from first-term grades was about .66.³⁶

There is another, more practical way of looking at the predictive validity of tests, especially for those who are concerned with weak students. With a grading system of A, B, C, D, F, students who get average grades below C are having trouble, and it would be helpful to identify them in advance, so they can be advised to drop out, or to take a light load, or to get extra help. The data of Table 11.11 were obtained from the records of 1239 men and

TABLE 11.11. Percentage of Students of Each Percentile Range on the CQT at Entrance Who Made Average Grades of C or Higher During the First Term

Percentile Range	Men	Women
90-99	90	98
80-89	81	93
70-79	78	91
60-69	64	91
50-59	64	88
40-49	45	73
30-39	42	72
20-29	30	55
10-19	22	40
0-9	10	32

SOURCE: Data from the Office of Evaluation Services, Michigan State Univer.

1126 women students at a large state university and are presented separately because the relations between test scores and grades are different. Making the assumption that these relations will continue in future years, one can look at Table 11.11 and say that only 30 percent of the men who get scores between 20 and 29 will get good grades the first term. Or, looking at the data for women, one can say that any girl who gets a score of 50 or better will make good grades—with only a few exceptions. A table of data arranged in this way to show what can be expected of people who get test scores within specified ranges is called an *expectancy table*.

An interesting study of the validity of prediction comes from the selection and training of 568 airline pilots and flight engineers.³⁷ Since the training of these men costs the airline around \$6000 each, selection of men who can complete the course is an important task. The tests used, originally developed by Air Force psychologists and revised for commercial air crew, have many parts, requiring arithmetic calculations, mechanical comprehension, and good judgment of emergency situations. They are scored on a scale of stanines, on which 5 is average, 1 very low, and 9 very high. All 568

men had been through the routine interviews and standard procedures and the airline did not hire anyone with a stanine score below 4, so the least promising men probably did not get into the training program. Nevertheless Fig. 11.19 shows that among the men with stanine scores of 4, 5, and 6 there were many who failed to complete the training, while at the high

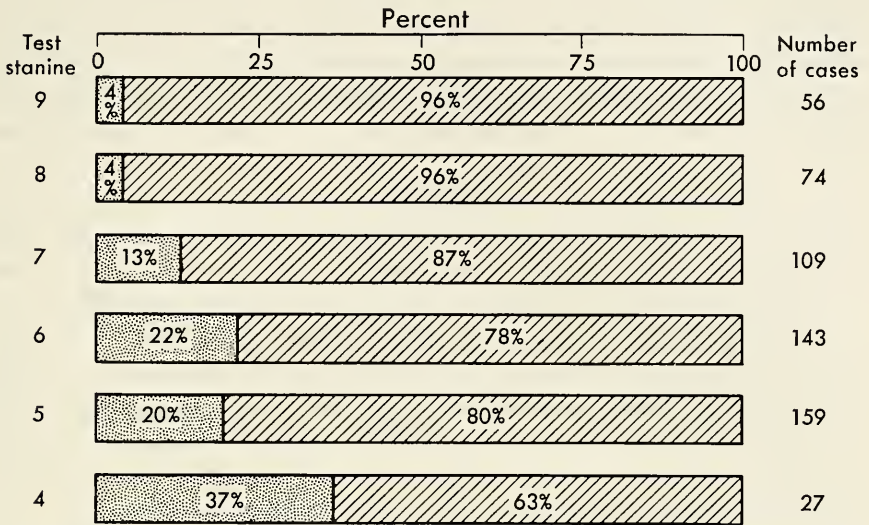


Fig. 11.19. Test scores and performance of air crew in commercial airline training course. At each test-score level the proportion who failed (stippled bar) and the proportion who passed (diagonal bar) is shown. For example, 159 applicants made a score of 5, of whom 20 percent failed and 80 percent passed. (From American Institute for Research, Pittsburgh³⁷)

end of the scale nearly all succeeded. Taking a closer look at Fig. 11.19, one can see that, when there are many applicants to choose from, the minimum score can be raised to 5, and thus even more of the poor risks can be eliminated.

In general this procedure, or some variation of it, is necessary for proving or validating the usefulness of a test for the selection of personnel. If the selection procedure includes interest tests, personality inventories, or biographical data, the validation procedure is the same, and one cannot be sure of the usefulness of these scores until the validity information has been obtained under conditions similar to those in which the testing devices are to be used.

SUMMARY

Previous chapters have been concerned chiefly with psychological principles that apply in a general way to all people, but in this chapter we emphasize differences between individuals. A psychological test is a standard

procedure for bringing individual differences out for observation and scoring. Ability tests are given under optimal motivation and working conditions and bring out responses that can be scored right or wrong.

Achievement tests are constructed by sampling a specified supply of tasks, such as a dictionary or a textbook. Aptitude tests are constructed of items intended to predict success in some occupation or course of training. In any case the test is given to a large number of people and the scores are statistically analyzed as a check on the reliability of the test. After preliminary results are available, the test is refined and made more reliable by eliminating items that are inconsistent with the others and adding consistent items.

Scores obtained from psychological tests are interpreted within a frame of reference formed by the scores of some specified sample of people. During the growing period age scores are useful, especially mental-age scores. During high school and college age changes are small, so percentile scores, or something similar, are used. The IQ, originally computed by dividing MA by CA, as on the Stanford-Binet Scale, is a useful index for comparing the abilities of individuals of different ages. When MA is not available, IQ's can still be obtained by arranging scores with the same percentile ranges as the original IQ's, as on the Wechsler Adult Intelligence Scale and the Wechsler Intelligence Scale for Children.

Abilities are analyzed by correlating a hundred persons' scores on one test with their scores on other tests. This procedure uncovers a general factor running through all tests of intellectual abilities, and it is possible to construct tests that emphasize this single factor of general intelligence. It is also possible to construct several tests of different abilities, such as verbal, numerical, and spatial abilities, which are somewhat independent of each other and useful separately or in combinations. Scores from a test of general intelligence, like the Stanford-Binet, reflect both genetic endowment and educational opportunities. Research has also shown the influence of specific environmental factors, such as vitamin deficiency, and certain rare hereditary disorders.

In the years that psychological tests have been available many groups classified in various ways have been compared, and the results of such comparisons, if the groups are representative samples of some defined classification of people, help to describe the abilities of the nation. During the school years comparisons between age groups show the differences that one would expect, due both to maturation and to education, but after age 20 it is necessary to distinguish cross-section comparisons from longitudinal comparisons. Old people score low on all tests given in the past few years, especially on speeded tests, but when the people who were tested at age 20 are tested again at 45, no decline appears but rather an increase, especially on tests of information and vocabulary.

When men and women are compared, no difference in general intelligence is found, but there are differences in special tests, such as mechanical information, along with considerable overlapping. Small urban-rural differences are frequently found, in favor of the urban and suburban samples, presumably because of better schools. Ethnic groups that do not enjoy the educational advantages of the dominant culture score below the norms of the dominant culture. Differences between socioeconomic classes are rather large on the average because of genetic factors, family expectations and advantages, occupational differentials in prestige and in intellectual demands, and the like, all of which are fairly stable aspects of our social structure.

In economic competition mental defectives are handicapped. The severely defective require institutional care, but the borderline cases can get along fairly well, especially if they have had special training adapted to their abilities. At the other end of the scale estimates by psychologists attribute very high IQ's to those historical geniuses whose childhood records permit evaluation. In most cases their great intellectual contributions were made rather early in life. When superior children are identified by intelligence tests and followed into middle age, their intellectual contributions are far above the average. Taking the whole range of ability, intelligence is closely related to success in school and in those occupations that make intellectual demands.

This relation between abilities and success permits the use of ability tests for selection of personnel for certain jobs. The job is analyzed and items are written to test the abilities required, or perhaps standard tests or biographical data are used. In any case the validity of the selection device is established by correlation of the scores with subsequent success on the job.

PRACTICE PROBLEMS

55. From the evidence reported in this chapter what statement could you make about the family origin of eminent men and women?
56. A psychologist once made the statement that "there will always be some very superior children but not many." On what basis could such a statement be made?
 - a. The shape of the distribution curve of intelligence.
 - b. Deficiencies in the national diet in many countries.
 - c. Population data from the national census.
 - d. Statistics on the number of children who succeed in school.
57. A test of general intelligence would have the highest validity in the selection of employees for which of these jobs? (a) Sewing-machine operator; (b) sewing-machine repairman; (c) payroll supervisor; (d) leather goods salesman.
58. Estimate from Fig. 11.19 how many failing men and how many successful men would be eliminated by moving the minimal score up to 5.
59. Mr. B studied several tests that he might use in selecting employees for clerical work in the Acme Products Co. and decided to use the Delta test, rejecting all

- applicants below a score of 47. In making this decision he carefully considered the distribution of abilities of the applicants who usually apply for work at Acme, the reliability of the test, time required to get it, and expense of keeping records. What important factor did he neglect?
60. Why do we use standardization samples for comparison of age groups and occupational groups?
 61. What is analyzed in item analysis?
 - a. The requirements for passing an item.
 - b. The consistency of the wording in relation to the wording of other questions.
 - c. The relation between the length of an item and its difficulty.
 - d. The relation between the item and the test.
 62. In discussions of the reliability of a test what does "error" mean?
 - a. The subject's mistake in answering a test question.
 - b. The subject's misreading of the question.
 - c. Inaccuracy in the score.
 - d. Setting the norms too high or too low.
 63. Which terms are synonyms? (a) Ability—reliability; (b) differential psychology—psychology of individual differences; (c) percentile score—mental age; (d) mental age—IQ.
 64. Which terms are synonyms? (a) Profile chart—distribution curve; (b) validity—reliability; (c) verbal ability—general ability; (d) mentally deficient—feeble-minded.
 65. In which pair of terms is the second an example of the first? (a) Job analysis—item analysis; (b) vocabulary—differential abilities; (c) age score—mental age; (d) psychological test—validity.
 66. In which pair of terms is the second an example of the first? (a) Mentally deficient—moron; (b) cross section—longitudinal; (c) verbal ability—numerical ability; (d) percentile score—IQ.
 67. Which terms refer to things of the same class? (a) Moron—mental age; (b) profile chart—job analysis; (c) achievement—norms; (d) imbecile—idiot.
 68. In which pair of terms is the second a measure of the first? (a) Intelligence—verbal ability; (b) age score—criterion; (c) intelligence—MA; (d) individual differences—correlation.
 69. In which pair of terms is the second a measure of the first? (a) IQ—MA; (b) correlation—rho; (c) sex difference—mechanical reasoning; (d) predictive validity—criterion.

Following are extracts from clinic records about one year apart:

April 14, 1958

Rachel B. Age: 6 years—6 months

Rachel was brought to the Psychological Clinic by her mother for examination because of rebelliousness at home and in school. The kindergarten teacher said she was "a bundle of nerves." According to the mother, the family doctor had said that Rachel was on the verge of a nervous breakdown.

She was given the Stanford-Binet Test, Form M, the Draw-a-Person test, and the Vineland Social Maturity Scale.

In the testing situation R. was friendly but hyperactive. She tended to gloss over her mistakes and put the materials away after relatively little success. After much persuasion Rachel tried to draw human figures but was unable to

do so, changing her figures into a "snowman" and a "gorilla," saying that she has never in her whole life drawn a person, preferring to draw flowers.

Summary. Rachel attained a mental age of six years on the Stanford-Binet test, which puts her in the average range of intelligence, but in social relations she is childish and egocentric. On the Vineland Social Maturity Scale she achieved a social adjustment about equal to that of a five-year-old. It is quite likely that her relatively poor control over her emotions may frequently lead her into difficulties with her social environment.

In view of her good intelligence, psychotherapy is recommended.

January 25, 1959

Rachel B. Age: 7—3

After therapy sessions about one a week for thirty weeks Rachel was examined again. She appeared to be alert and interested in her surroundings but quite relaxed. She was given the Stanford-Binet (Form L) and achieved a mental age of 8—9. Her performances on the Draw-a-Person test were 7—6 and 7—9. She said she had played similar games once, across the hall. "This was fun. I liked it a lot." Her drawings indicate that she may be uncertain of her identification with the female role.

70. Compute Rachel's IQ on the Stanford-Binet in 1958.
71. Compute Rachel's IQ on the Stanford-Binet in 1959.
72. Give two reasons for the large gain in IQ.
73. From this report one could infer that the Vineland Social Maturity Scale is evaluated in terms of (a) percentile scores; (b) IQ; (c) deviation IQ; (d) age scores.
74. The old saying that students can become feeble-minded from overstudy is just a superstition. True or false?
75. "Most brilliant children are physically frail." True or false?
76. "Most brilliant thinkers were rather dull as children." True or false?
77. From Fig. 11.5 estimate the percentage of children with IQ's below 80; above 100.

Following are four responses to the intelligence test item which asks: "Why do fire trucks have sirens?" Score each P for pass or F for fail.

78. ____ To make a loud noise.
79. ____ To scare the people.
80. ____ To warn people to get out of the way.
81. ____ To make the people jump.
82. One can infer from Table 11.11 that women students make better use of their abilities than men do. Is this a valid inference?
83. From Table 11.11 predict what would have happened if the university had lowered entrance requirements and accepted men of lower test scores.

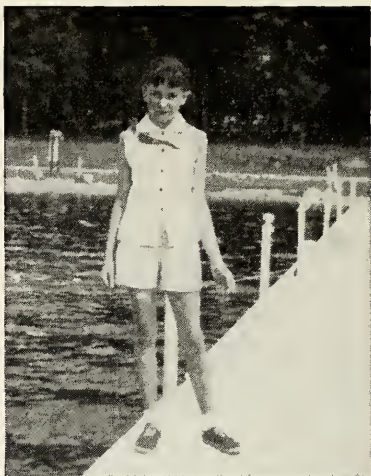
Discussion Questions

- A. Is it true that "all men are born equal"?
- B. Bernard Shaw once said that the progress of the world depends on young people's knowing more than their elders. In what sense can this be true?

- C. Name some important abilities not discussed in this chapter.
- D. Is a generally high level of intelligence more important for a democracy or for a dictatorship.
- E. When employees are selected on the basis of test scores, is there a danger that a truly creative individual will be overlooked?

Recommended Reading

- L. J. Cronbach. *Essentials of psychological testing*. Harper, 1960. A standard textbook on testing abilities, achievements, and personality. Illustrations of tests, methods of testing, and interpretation of results.
- A. Anastasi. *Differential psychology*. Macmillan, 1958. A standard textbook, full of information about differences between individuals and between groups in ability and personality. The evidence on differences associated with heredity, family, sex, and social class is surveyed critically.
- H. C. Lehman. *Age and achievement*. Princeton Univer. Press, 1953. A thorough investigation of age and achievement in art, science, literature, and athletics.
- L. M. Terman & M. H. Oden. *The gifted group at mid-life*. Stanford Univer. Press, 1959. The latest report on the thousand children of very high intelligence that Professor Terman identified in the 1920's. Health, education, occupation, notable achievements, recreation, politics, and family life of these men and women, now in their 40's.



Chapter 12. PERSONALITY

The personality of a human being is an intricate pattern of glands, motives, habits, concepts, and social roles, all organized in a unique structure that holds together, however precariously, against the pulls and pushes of the outside world. The preceding chapter described human beings in respect to abilities, and the present chapter describes them in many other respects, using the concepts of preceding chapters whenever possible. But it is not enough to describe people's separate traits; we would like to know how these traits are organized into the distinctive structures that make each person a unique individual, a personality. We want to describe people as completely as possible—not hypothetical or average people, but specific human beings, like the man who steps up to borrow a match, the housewife next door, and the student who wears those funny clothes. We will need to discuss a variety of methods, literary as well as quantitative, for describing individuals. Then we shall turn to the development of personality and try to account for the origins of these curious bundles of natural phenomena.

THE DESCRIPTION OF PERSONALITY

The first task in any scientific undertaking is to describe the objects of investigation. In preceding chapters we have had to describe patterns of behavior, simple and complex, individual and social, but how can unique personalities, which differ from each other in so many human ways, be described? Actually people have been talking and writing about other people for many years, often carelessly and emotionally, often thoughtfully. Two examples of a familiar literary form, the *character sketch*, which has just this function of personality description, are printed here to illustrate the breadth and complexity of our topic and the kinds of information available. The first is part of a letter about General George Washington, written to a friend by Thomas Jefferson. It is dated January 2, 1814.

. . . I think I knew General Washington intimately and thoroughly; and were I called on to delineate his character, it should be in terms like these.

His mind was great and powerful, without being of the very first order; his penetration strong, though not so acute as that of a Newton, Bacon, or Locke; and as far as he saw, no judgment was ever sounder. It was slow in operation, being little aided by invention or imagination, but sure in conclusion. Hence the common remark of his officers, of the advantage he derived from councils of war, where hearing all suggestions, he selected whatever was best; and certainly no general ever planned his battles more judiciously. But if deranged during the course of the action, if any member of his plan was dislocated by sudden circumstances, he was slow in readjustment. The consequence was, that he often failed in the field, and rarely against an enemy in station, as at Boston and York. He was incapable of fear, meeting personal dangers with the calmest unconcern. Perhaps the strongest feature in his character was prudence, never acting until every circumstance, every consideration, was maturely weighed, refraining if he saw a doubt, but, when once decided, going through with his purpose, whatever obstacles opposed. His integrity was most pure, his justice the most inflexible I have ever known, no motives of interest or consanguinity, of friendship or hatred, being able to bias his decision. He was, indeed, in every sense of the word, a good, and a great man.

His temper was naturally irritable and high toned; but reflection and resolution had obtained a firm and habitual ascendancy over it. If ever, however, it broke its bonds, he was most tremendous in his wrath.

In his expenses he was honorable, but exact; liberal in contributions to whatever promised utility; but frowning and unyielding on all visionary projects, and all unworthy calls on his charity.

His heart was not warm in its affections; but he exactly calculated every man's value, and gave him a solid esteem proportioned to it.

His person, you know, was fine, his stature exactly what one would wish, his deportment easy, erect and noble; the best horseman of his age, and the most graceful figure that could be seen on horseback.

Although in the circle of his friends, where he might be unreserved with safety, he took a free share in conversation, his colloquial talents were not above mediocrity, possessing neither copiousness of ideas, nor fluency of words. In public, when called on for a sudden opinion, he was unready, short and embarrassed. Yet he wrote readily, rather diffusely, in an easy and correct style. This he had acquired by conversation with the world, for his education was merely reading, writing and common arithmetic, to which he added surveying at a later day. His time was employed in action chiefly, reading little, and that only in agriculture and English history. His correspondence became necessarily extensive, and, with journalizing his agricultural proceedings, occupied most of his leisure hours within doors. On the whole, his character was, in its mass, perfect, in nothing bad, in few points indifferent; and it may truly be said, that never did nature and fortune combine more perfectly to make a man great, and to place him in the same constellation with whatever worthies have merited from man an everlasting remembrance.¹

The second example consists of excerpts from a recent *New Yorker* profile by Robert Lewis Taylor.*

Jacques André Istel, a twenty-nine-year-old French-American with a Princeton education and a distinguished family background of banking and international finance, is the nation's leading parachutist. Istel is a naturalized citizen with a perpetually gnawing sense of obligation to his adopted land, and he wishes to pay off his debt by seeing all adults under eighty parachute from airplanes, many of them several times daily. Toward this alarming goal he is progressing, or jumping, with astonishing celerity. A number of years ago, he took over a dozing organization called the National Parachute Jumpers-Riggers, a kind of amateur sports group with minus thirty members (that is, thirty members who had long since let their dues lapse), and converted it into the Parachute Club of America, a non-profit organization that now has a paid-up and fervent membership of eight hundred and fifty-nine.

Istel is, of course, a fanatic, but, like many fanatics, he is about as right as it's possible to get without being offensive. He is bitterly chagrined that the United States stood idly and characteristically by while a feverish parachute movement gathered steam (and military approval) in the Iron Curtain countries. He is convinced that we have a great deal of catching up to do, and he means to see that we do it, at whatever cost to his person, his purse, and his pride. For the accomplishment of these and kindred aims, Istel is magnificently equipped. He has the unabashed drive of a young adult gorilla in especially fine condition. The fact is that Istel is not unsimian in appearance—in an agreeable and even a hypnotic way—largely because of his posture, which at nearly all times is the crouching stance of a man about to do a swan dive out of an airplane. The illusion is heightened by his facial expression, an arrangement described by his school yearbook as “fiendish” (but actually the intense look of a young man in a hurry), and by his powerful sloping shoulders, his deep chest, and his rolling, Dutch-sailor's gait. Istel has jet-black hair trimmed in a crew cut that droops slightly forward, and he wears the standard Eastern-college uniform of oxford-gray or khaki trousers with tweed jacket. Altogether, at twenty-nine he still manages to look like an undergraduate, if one of unique character and purpose. Early each morning, he bounds out of bed and, bone nude, does fifty push-ups and a long series of spine-crunching bends from a sitting position on the floor. Then he drives to a nearby airport and gets in several parachute jumps before breakfast.

Today Istel is an earnest, careful, and conservative businessman, the proprietor of an outfit called Parachutes, Inc., which is in the business of designing innovations and refining safety features, but this was not always so. From all reports, including those of his dearest kin, Istel has been a handful almost from his birth, which took place in Paris on January 28, 1929. The major part of his first schooling was managed by tutors, none of whom had the durability to stay with the job very long. In the end, a private school was induced to accommodate him for one day a week, and his mother handled the rest. When America's future parachuting champion arrived in New York,

* Excerpts from a Profile article by Robert Lewis Taylor in *The New Yorker*. Reprinted by permission; © 1959 The New Yorker Magazine, Inc.

aged eleven, his parents resolved to lodge him in a good strong school; that is, one with a reasonable chance of holding him. As things turned out, the fuss was largely unnecessary. Istel settled into boarding school life with joy and cooperation, comparatively speaking, and began to be unbored for the first time he could remember. Though he meshed tractably with the school machinery, he remained supercharged with energy, and he spent many of his spare hours doing odd jobs on the campus—raking leaves, mowing lawns—to raise money. Jacques' father, a wise and observant parent, foresaw that overloading a boy of his son's calibre with cash would be like pouring gasoline on a hotly burning fire.

His yearbook, class of '45, presents him as the student most likely to succeed, and is sprinkled with those scribbled lyric partings of friends, the sad last songs of school life. Prophetically, from Ed: "To a Frenchman that always takes a double dare, lots of everything." And from Bill: "Good luck to a fellow 'long-distance hitchhiker.' Sincerely, your pal." This reference to travel alludes to an extracurricular sport that Istel developed during his boarding school phase. In the summers, he struck out, usually alone, to see the country. This was accomplished without much in the line of a parental blessing. Usually, Jacques hitchhiked, picking up jobs here and there along the route, but he once took a thousand-mile bicycle trip through New England, sleeping in barns. On this tour, he gained lucrative employment as a concrete mixer in Vermont. One day, he and a colleague were called in on an emergency job at an expensive hotel; a chimney had tumbled down. By a regrettable coincidence, Istel stalked through the dining room, in costume and carrying a hod, at the very time when his parents (off on a vacation, unknown to him) were having lunch. He was tickled to death to see them. "Hello, Mama and Papa!" he cried in a voice that rang through the room. "Comment ça va?"

Istel, having achieved a certain unconventionality through his impecunious meanderings over the nation, arrived at Princeton wearing blue jeans and a leather jacket. College seemed little more than a stumbling block on the road to progress; he felt ready for the world. During his first two years at Princeton, Istel was miserable, wallowing through a course of economics decreed by his father as the prelude to a career in banking, and wishing, usually, that he was off hitchhiking or pouring concrete in Vermont.

At the moment of Jacques Istel's Princeton commencement, he was sleeping in a haystack in England. Deciding not to wait around for the ceremony, he had embarked on a hitchhiking trip of importance. He went steerage to England, covered the British Isles, removed to Scandinavia, which he viewed with thoroughness, and then casually thumbed on down into North Africa. When he returned to New York, his father, irate at last, collared him and dragged him, almost by the use of leg irons, into Wall Street. Now began young Istel's travail in the wilderness; it was easily the low point of his life. For a brief spell, he was sent to Paris as a combination student and employee at his father's banking house, but Paris offered really stupendous ways of avoiding bank work, and the partners soon agreed that as a Paris banker the boy would be far more effective in New York. He returned to Wall Street. To offset his anguish, he began surreptitiously taking flying lessons at Armonk. He soloed after seven hours, and qualified for a private license. At this time, his parents noticed that he seemed, somehow, much happier.

To Istel, the Korean War came not only as a patriotic opportunity but as a welcome respite. When he attempted to enlist in the Marine Corps, immediately on the announcement of hostilities, he ran into citizenship trouble. He had put in for naturalization, but approximately three months more had to elapse before his papers could come through. In the interim, he made his first parachute jump—one of the genuinely significant actions of his life. He had learned that there existed an amateur sports group, the National Parachute Jumpers-Riggers, and that its head, and sole guiding genius, was a man named Joe Crane, who lived in Mineola, Long Island, running a parachute-maintenance company. Istel called on him with a request to rent a chute. Crane vehemently denounced the offhand project as premature. On leaving, with the rented chute, Istel repaired to an airport at Deer Park, Long Island, hired a pilot, soared into the blue, and leaped out. The jump turned out to be ragged and inaccurate but uncomplicated by fractures, and Istel was ready for more. His next jump was also uneventful, but his third landed him in Westchester County Court. In this episode, Istel came down in a tree on the Saxon Woods golf course; that is, he was left dangling in it, an object of some attention. The tree overhung the Hutchinson River Parkway, upon which traffic was securely tied up for about two hours. Undismayed by this setback, he began planning more jumps, but at that point his citizenship came through and he hurried into the Marines.

When Istel's discharge from the service had come through, he was spiritually bruised to learn that he was expected to reenter Wall Street. This time, however, his sentence proved to be short-lived. A friend in Paris wanted a Mercedes 300 SL, a sports racer that could then be bought only with dollars. Istel got him one, and lost little time wrecking it on the icy upsloping drive of his Bedford Village home. With the insurance money, he bought another Mercedes, a model identical to the one that had won a recent Pan-American road race, in Mexico. When the second racer arrived, Istel eyed it with interest, plus a familiar, yeasty feeling of exploration. Finally, at around 2 A.M., he knuckled under, climbed in the car, and headed for the New Jersey Turnpike. Frequently, along the road, police cars took up the chase, but Istel, in his souped-up Mercedes, was doing a hundred and twenty-five miles an hour by the radar check. The runaway was finally stopped with a full-scale roadblock, somewhere near Camden. Hauled into a hastily convened court, Istel was contrite. He told the authorities the truth; he hadn't wanted to inconvenience anybody; his motive had been simple and scientific—he had wished to see how fast the car would go. When his father called him in to the New York company office, the parental message was more thoughtful than angry. "You're a good boy, Jacques," said André Istel. "Certainly you're an interesting boy. But I must tell you that I can at last see clearly that your heart is not in the investment-banking business. Whatever your future business ventures may be, I wish you the best of luck in them. *Au revoir.*"

Not long after this rupture, he began his real career, with parachutes. All along, something had been lacking, some foreordained channel into which he could pour his overflowing vitality. For a while, he worked for a New Jersey company called Air Associates, which dealt in aircraft supplies and electronic equipment, but his heart and his mind were aloft. It was probably the Vienna parachuting conference, to which Istel, at Joe Crane's suggestion, went as the United States delegate, that urged him down the correct path.

When he came back, he was fired with zeal not only to raise a team for the impending championships in Moscow but to improve American parachuting in general, including that of the military, to the level of parachuting in Europe. Not long ago, a large aviation company told Istel that no man could sky-dive from a plane while wearing a fifteen-pound camera strapped to his helmet; his neck, they said, would instantly snap. Istel, with camera attached, was in the air inside of a week, and took some startling pictures, in midflight, of a sky diver who had preceded him a moment before.²

Looking back over these sketches, one can see what writers do when they write about people. They describe appearances: "stature exactly what one would wish"; "the crouching stance of a man about to do a swan dive out of an airplane." They relate specific incidents: dangling in a tree over the parkway. And they generalize about habitual styles of action: "never acting until every circumstance, every consideration, was maturely weighed"; "In the summers, he struck out, usually alone, to see the country." Furthermore, they occasionally attempt to dig below the surface and uncover the dynamics of the observed behavior: "His temper was naturally irritable and high toned; but reflection and resolution had obtained a firm and habitual ascendancy over it." "All along, something had been lacking." They include the opinions of others: "the common remark of his officers"; "His yearbook . . . presents him as the student most likely to succeed." Jefferson, in the literary fashion of his time, leans toward direct statements about abstract qualities or traits, such as prudence, judiciousness, and fluency, while Taylor, in the literary fashion of his time, relates specific colorful details which the reader combines into a convincing unitary impression. Many writers, especially dramatists and biographers, like to show their hero in a crisis. But in a well-constructed play, as in life, the character's conduct at the moment of truth cannot be independent of his previous conduct.

Whatever the purpose of the description, much selection and rearrangement takes place. There is no use describing everything a person does. He eats, talks to friends, reads the paper, sits down, stands up, and so on. His actions may be characterized as abrupt, absent-minded, abstemious, academic, accommodating, accurate, acquiescent, acquisitive, active, adventurous, and so on, to zealous and zestful. Writers can select any of the thousands of words that best describe a person and put them together in sentences and paragraphs as they choose. Psychologists also write sentences and paragraphs about people but, in addition, for the systematic study of personality, they often try to concentrate the description in terms of certain standard characteristics or traits.

Personality Traits

It is hardly possible to study or even to talk about personality as a whole. Biographers, novelists, and psychologists have to analyze personality into

simpler constructs, called traits, hoping that the analysis does not distort the unity of personality. A *personality trait* is a distinctive and consistent characteristic of behavior by which one person may be compared with others. Certainly it is the distinctive characteristics of behavior that help us describe personality. To know that someone talks is not distinctive because almost everyone talks. It is more helpful to describe people in respect to some characteristic on which people differ widely, such as frequency of talking, or choice of topics. Consistency is necessary also. If a girl strikes up a conversation with a stranger in an elevator once, that is hardly important. But if she consistently starts conversations in elevators, waiting rooms, classrooms, and drugstores, that is a feature of her personality that should not be overlooked.

Abilities, which are traits of a special class, were discussed in the preceding chapter, and the methods for determining the consistency of personality traits are the same as those used for determining the consistency or reliability of the scores on an ability test. People are observed on different days in different situations, and the acts of a certain kind, e.g., aggressive, are counted each time. These scores for a hundred people in one situation on one day are correlated with scores for the same people in another situation on another day. If the correlation is high, it means that the scores represent a distinctive and consistent aspect of these people's conduct—that is, a personality trait. For example, if we measure independence by recording five kinds of activity—taking initiative, overcoming obstacles, persisting, getting satisfaction from activity, and wanting to do things alone—children who are rated high on one of these activities are rated high on the other four. Similarly, if we treat dependency as a drive for five kinds of goal activities—physical contact with adults, proximity to adults, and seeking attention, help, or approval from adults—those children who are rated high on drive for one of these goals are rated high on the other four.³ By and large, those children who rate high on independence rate low on dependency, so if we have records of a child on these 10 activities, we can compare him with others in respect to the whole range of independence in general, an important personality trait in both children and adults.

Often, when the data are all in, it turns out that the records are not consistent. A child gets a high score for honesty at recess but cheats often in the classroom. When this happens, the psychologist tries to sharpen his tools. Perhaps the tests or observations need to be lengthened, or refined. Perhaps the examiners need more training. When the scores are accurate but the descriptions obtained from them are not consistent, the only logical conclusion is that the people are not consistent. In respect to honesty, for example, careful research with young children has failed to produce evidence of much consistency. The degree of honesty shown in different situations depends

not so much on the character of the child as on the character of the situation, the social pressures, and the child's interpretation of the expectations of his peers. Hence young children simply do not have such a trait as honesty; to describe them by such a trait name is deceptive.

Here, as in so many noble human projects, it is words that have led thought astray. Because there is a word "honesty," it is easy to suppose that there is a trait honesty, and that one child can be usefully compared with another in respect to honesty. Modern psychology, however, has learned to be wary of words and not to expect consistency of behavior unless there is a reason for the consistency. Later in this chapter we shall see how consistent personality traits originate in biological processes, in the early environment, and in reactions against these. For example, when they reach the sixth grade, boys do show some consistency in respect to honesty.⁴

Systems of Traits

As the psychology of personality has advanced and the number of known traits has increased, the necessity for classifying these traits in some systematic arrangement has become apparent. After describing, for instance, how emotional a person is, one could go on to describe how peevish he is, how petulant, fretful, cross, irascible, irritable, excitable, hot-tempered, moody, and grouchy he is. But these traits overlap. One who is high on two or three of them is high on the others. It would be an absurd waste of effort to grade a person according to every trait one can think of.

What we need is a manageable number of common traits, more or less independent of each other, chosen so that scores on all traits will give us the major outlines of personality, the major dimensions on which people can be compared. The information contained in seven or eight overlapping traits, in fact, can often be consolidated in two independent traits. The statistical methods used in this hunt for an efficient system of personality traits are the same as those used to analyze and classify intellectual abilities, but the hunt is more difficult because the personality is more complicated than the intellect, and no large general factor, comparable to general intelligence, has been found. There is no one correct classification of personality traits for the same reason that there is no one correct classification of library books, or flower seeds. The following list of traits, applicable to normal people, reflects recent research on analysis of traits, extends the previous discussion of individual differences in motivation, and supplies trait names for describing personality and for later discussion of methods and development.⁵ As research on personality progresses, some of these will be eliminated or consolidated with others, and new ones will be added.

Eleven Common Personality Traits

Activity. People differ greatly, even in the cradle, in amount of activity. Those on the high side of this trait are called restless, energetic, active. Those on the low side are called lethargic, quiet. We are not talking about what people accomplish but how much they move, not what they say but how much they talk.

Anxiety. Some people report that they feel insecure, on edge, as if something fearful is about to happen. Everyone has some anxiety, to be sure, but those at the high end of this dimension often feel threatened by their troubles. They are worried and find it hard to relax. People at the low end are described as secure. This trait resembles individual differences in the acquired drive discussed in Chapter 3.

Sociability. Individual differences in strength of the motive for interaction or affiliation with other people constitute a prominent aspect of personality. People high on this trait are described as extroverted, gregarious, friendly. They report that they enjoy companionship with others. Unsocial people are described as solitary, shy, introverted, and they report that they often prefer to be alone.

Independence. Variations in fear of social disapproval constitute an important part of this personality trait. Those at the high end of this scale go their own way and don't care what other people think of them. Thus they may be called radicals, nonconformists. People at the low end are called dependent. They are sensitive to the opinions of others, and they worry about the effects of their clothes, their words, and their actions on other people. They like to lean on other people or on a group or a custom. They may be called conformists, conservatives.

Achievement. This is another social motive which helps to describe personality. Those high on this trait are called ambitious, industrious, persistent. They are oriented toward success—though “success” has different meanings for different people—and they worry about failure. Those low on this trait are described by others as satisfied, lazy, passive.

Masculinity. This term is used in psychology to refer to gestures, speech habits, interests, and attitudes that are typical of men rather than women. Femininity has the opposite meaning. An interest in grinding valves, for instance, is more masculine than an interest in arranging flowers. Voices from hidden sources can easily be identified as masculine or feminine, and so can the movements used in throwing a ball. The average man is more masculine than the average woman, of course, but there is considerable variation within each sex. Some men are less masculine than the average woman and some women are more masculine than the average man.

Dominance. This is not so much a motive as a habit of social interaction. Dominance is also called ascendancy; the opposite is submissiveness. People high on this trait are rated confident, self-assertive, forward, boastful, forceful. Submissive people are rated obedient, modest, polite, retiring. In a situation involving two persons the more dominant one takes the lead. Non-dominant people feel uncomfortable in front of a social group and try to merge into the background.

Aggressiveness. This is another habit of social interaction, the essence of which is readiness to pick a fight, to do harm to someone, either by word or deed. A highly aggressive person is described as hostile, belligerent. His enemies—and he probably has enemies—say that he has a chip on his shoulder. Those low on this trait are described as peaceful, agreeable.

Adaptability. Another way of describing people is in terms of their flexibility, their ability and willingness to go along with the plans of others. People high on this trait are called easygoing, realistic, cooperative. They find it easier to adopt a new point of view than those at the low end of the scale, who are called rigid, pedantic, obstructive, dogmatic, stubborn.

Seriousness. Some people take life pretty seriously; others have a more carefree, lighthearted approach. The serious ones are particular about their clothes and considerate of the feelings of others. They stop and think before they act. Those at the low end of this trait love excitement. They are impulsive, with a tendency to jump to conclusions.

Emotional Control. People vary considerably in ability to inhibit their actions, and emotional control can be used to characterize the behavior of people in many conflict situations. The core of this trait is the control of behavior by ethical values or abstract ideals, such as the ego or the self concept. Thus this trait, or something like it, may be called ego strength or self-control; many people call it strength of character, emotional maturity, tolerance of frustration. Those low on this trait are rated weak, fickle, distractible, unstable.

Some traits are named by reference to one extreme or the other—for example, dominance at one end and submissiveness at the other—and we often talk as if there were two types of people, the dominant and the submissive. But this is just an accident of naming. As far as we know, common personality traits are distributed as abilities are distributed, with most people at the middle of the scale and a few at each extreme. See Fig. 12.1 for a profile chart, describing George Washington in reference to these 11 common traits.

Interests, values, and attitudes are common traits that are useful in describing personalities (see Figs. 3.6 and 3.7). Specific likes and dislikes are not so important as the broad factors, listed in Chapter 3, which influence decisions in many situations, such as a love of machinery, a high aesthetic

value, or a general attitude of conservatism. See Fig. 12.2 for an attempt to chart George Washington's values.

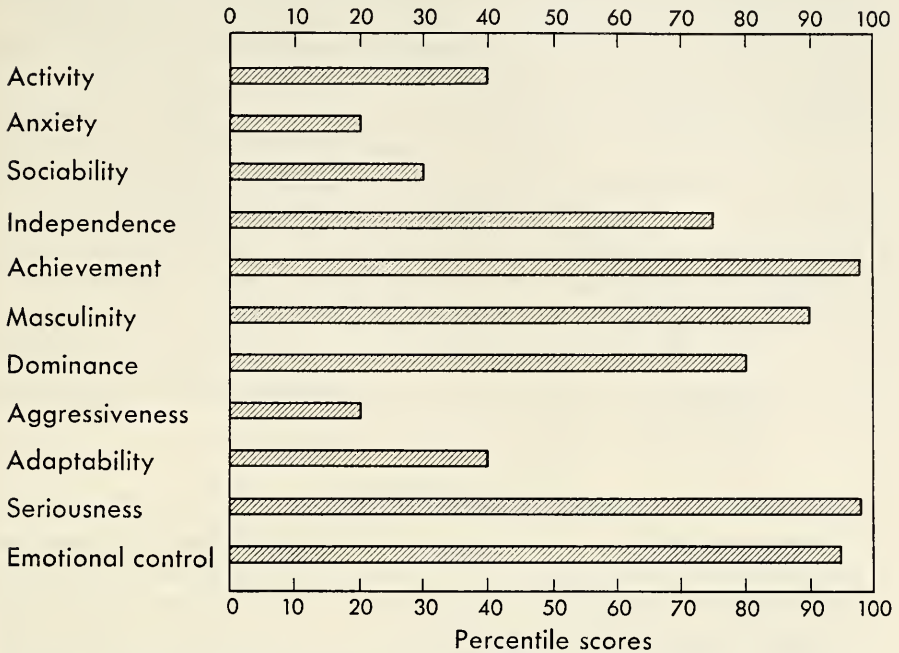


Fig. 12.1. Ratings of George Washington on 11 common traits. (The ratings are based on a short character sketch and cannot be considered very accurate.)

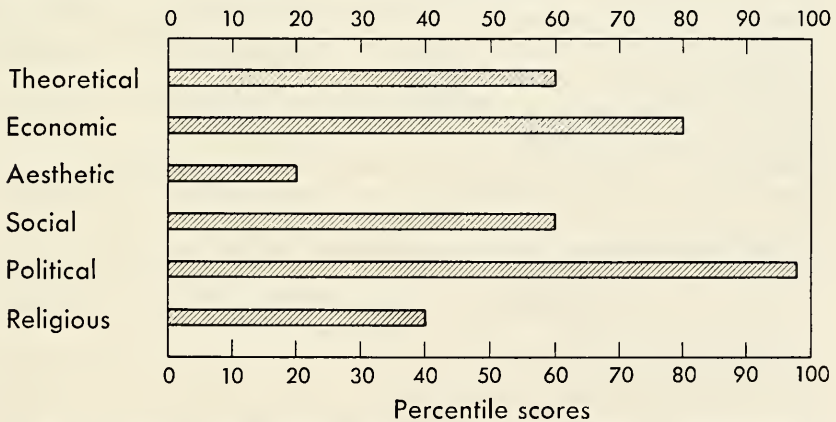


Fig. 12.2. Ratings of George Washington on six values. (The ratings are based on a short character sketch and cannot be considered very accurate.)

Individual Traits

A limitation of our list of 11 traits is that it contains only common traits, not individual traits. Much of George Washington is missing. A *common trait* is one, like those above, that everyone shows in some degree, and the more

systematic and quantitative side of the psychology of personality necessarily deals with common traits. An *individual trait* is one, like a guilt feeling over a high school escapade or a love of parachuting, that characterizes one individual but does not supply a scale on which all can be graded. A person's self concept, his social role, his ego defenses, and techniques for handling his anxieties are individual traits rather than degrees of common traits. The concepts or dimensions on which a person judges himself, his achievements, and his social relations may be personal constructs of his own invention. A writer's style is an individual matter. Jacques Istel's rebelliousness in relation to banking may be considered an individual trait since most people do not get involved in such difficulties, and it would be pointless to compare people in this respect. Individual traits are hard to classify and investigate, but they cannot be overlooked because such peculiarities often characterize the individual as a unique person more than do the easily measured common traits.

PRACTICE PROBLEMS

1. Psychologists refer to a human being by several different terms when they are emphasizing different aspects of the human being. What do they call him (a) when he is taking part in an experiment? (b) when he is taking part in an experiment on vision? (c) when they contrast him with a group of human beings? (d) when they wish to emphasize the unity of his physiological processes? (e) when they wish to emphasize his individuality? (f) when he is rating other human beings on personality traits?
2. From your study of personality traits predict whether a highly sociable person will answer yes or no to this question: When you have an important decision to make, do you prefer to make it alone?
3. Predict how a person high on emotional control will answer this question: Have you ever been a sleepwalker?
4. Predict how a highly dominant person will answer this question: If something goes wrong and it is not your fault, do you usually make a public complaint or hide your annoyance?
5. Scores of eight people on three common traits and one individual trait follow. Which is the individual trait?
 - a. 3, 7, 21, 6, 14, 12, 7, 13
 - b. 0, 0, 0, 0, 0, 1, 0, 0
 - c. 91, 82, 56, 37, 43, 82, 51, 62
 - d. 1, 6, 3, 2, 0, 5, 4, 4
6. The question "Does tea keep you awake?" belongs on a test of (a) anxiety; (b) adaptability; (c) dominance; (d) achievement.
7. The question "Do you often feel self-conscious in front of a group?" belongs on a test of (a) independence; (b) aggressiveness; (c) sociability; (d) dominance.
8. A question about attitude toward religion is likely to be found on a test of (a) sociability; (b) achievement; (c) independence; (d) dominance.
9. An experimenter once complained that his high-scoring subjects took the ex-

periment away from him and ran it themselves. He was probably talking about scores on (a) aggressiveness; (b) achievement; (c) dominance; (d) activity.

10. People who agree with the statement "Most people in this world are looking for trouble" are likely to be rated high on (a) aggressiveness; (b) adaptability; (c) dominance; (d) emotional control.
11. Which of the 11 traits listed in this chapter has the strongest moral involvement?
12. Are personality traits responses or constructs?
13. Fig. 12.3 shows three profile charts, one of which is intended to represent Jacques Istel on 11 common traits. Which one is it?
14. Fig. 12.4 represents the interest profiles of three men. Which is Jacques Istel?

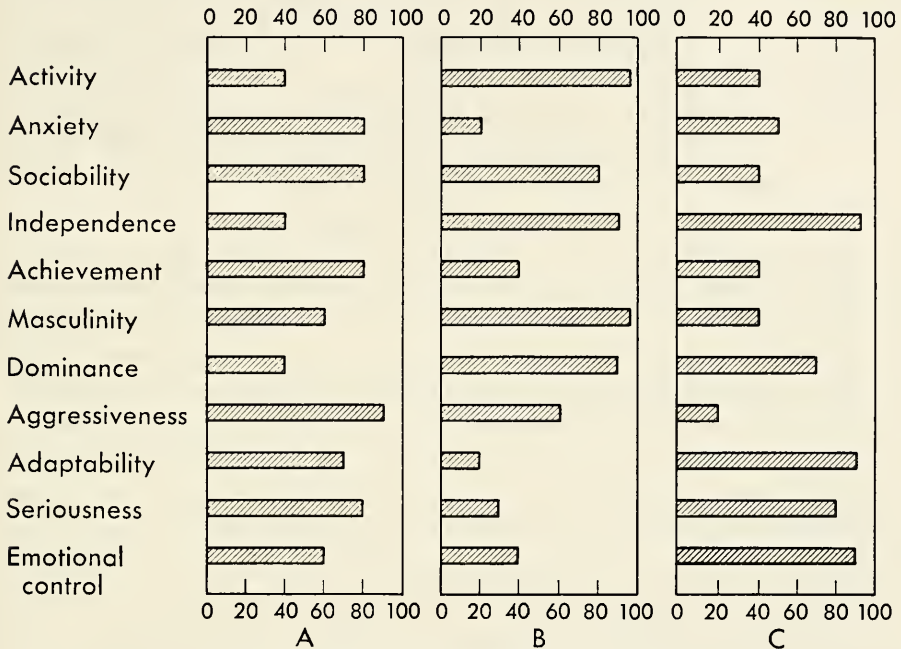


Fig. 12.3. Ratings of three individuals on 11 traits.

METHODS FOR ASSESSMENT OF PERSONALITY

A human personality is an elusive object to assess, and psychologists have been forced to invent a variety of methods and a variety of materials to go with them, each of which has its own advantages and disadvantages. The methods can be grouped under five headings: "Observation of Behavior," "Rating Personality Traits," "Performance Tests of Personality," "Personality Inventories," and "Projective Tests."

As we study these various methods and as we size up any particular personality, the problem of inference is always with us. It is not enough just to

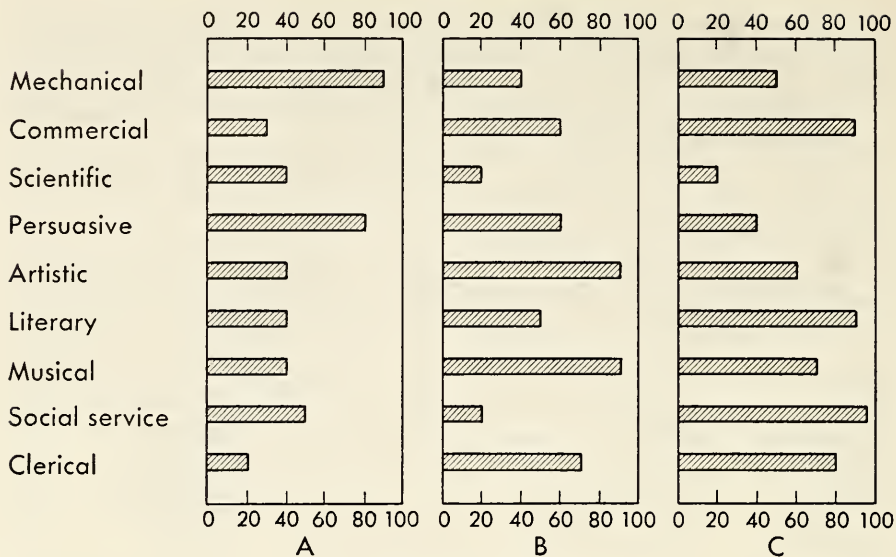


Fig. 12.4. Interest profiles of three men.

count the times a person initiates a conversation or to record his answers to questions. We want to make inferences from the observable facts to our theoretical constructs, the personality traits. Some of the methods to be described make this logical step in a straightforward way, as when we observe a person's activity and put him down as restless or quiet. Other methods, as we shall see, make roundabout inferences that are hard to follow.

Another persistent problem is the problem of disguise. Ability tests need not be disguised because everyone does his best, and that conforms to the definition of ability. To describe personality, however, we do not want to know the best a person can do but what he usually does, what he feels, and what he fears. Unfortunately, when people describe other people, they tend to rate them high, to compliment them. And when they describe themselves, they tend to rate high also. Therefore it has been necessary to disguise some tests so that the purpose is not obvious and the tendency to make socially desirable responses is minimized. In examining the various methods of investigating personality we should note whether the critical features are obvious or disguised as well as how the inferences about traits are made.

Observation of Behavior

The most direct method of assessing personality is to observe what people actually do. The best index to life is life itself. People can be compared in respect to the general trait activity by counting the number of words each speaks, the number of places each visits, the number of steps each takes,

and the like. People can be compared in respect to dominance by watching them in social situations and recording the number of times each follows, submits, or defers to another and the number of times he leads or bullies the other. People can be compared in respect to independence by watching them in situations in which some conform to a norm and others do not. Following this strategy psychologists have watched children in school and at recess, counting fights, smiles, and expressions of sympathy. Others have climbed into the cockpit to observe beginning pilots' emotional responses. Speech is, of course, a particularly revealing type of behavior—not only what a person says but how he says it. A simple comparison of individuals in frequency of use of the pronoun “I” is often revealing.

When we cannot directly observe people in action, we can use the records of action which our bureaucratic civilization provides in abundance. Records of loans, police actions, books borrowed, memberships in organizations, election to office, jobs held and lost, promotions and other occupational successes and failures, illnesses, and purchases supply evidence for the psychologist as well as the biographer. Any available product of creative thought—a poem written, a picture painted, a dress designed, a room decorated, or an invention patented—is likely to be a unique expression of the thinker's personality. Diaries, letters, and budgets are particularly lucky finds.

Under the best conditions this method provides direct evidence of personality. If a person talks a lot, he is a talkative person. If he has often been arrested for public intoxication, he is below average in emotional control. One disadvantage is the difficulty of getting a representative sample of observations or records of behavior. You might watch someone for a hundred hours before seeing him in a wide range of situations from which his typical level of adaptability or of aggressiveness can be estimated. Also the observations and records of behavior must usually be supplemented by the observer's judgment. Independence is not directly observed; people are observed in social situations doing all kinds of things, and from such behavior judges make ratings of independence, or anxiety, or sociability, and others. Hence the judgment of personality traits has become a large part of personality assessment. Diaries, letters, and other imaginative products do not reveal motives and styles of life directly; analysis and judgment are required.

Rating Personality Traits

A personality *rating* is one person's judgment of another person communicated to a third person. This is a natural way to proceed because a large portion of personality consists of one person's effect on another. Thomas Jefferson's opinions about George Washington can be considered trait ratings.

Jefferson does not report specific observations of behavior. Presumably he made these observations earlier and from his recollection of them he made an overall estimate of G. W.'s irritability, his judiciousness, and so on, then put his estimates in a letter. Terms like "irritability" and "judiciousness" are abstract concepts, which one learns partly from personal experience and partly from reading and conversation, just as one learns concepts like "apple" and "imperialism." One learns not only the meaning of the trait name but also the amount of the trait shown by the average person and the range of variation above and below this average. In other words, one learns, as described in Chapter 8, a scale on which terms like "irritable" and "very irritable" are located. To rate a personality on this scale one abstracts from the ebb and flow of behavior the responses pertinent to this concept, responses like emotional outbursts, facial gestures, and changes in the voice, and then combines these signs into a general statement of the subject's position on the conceptualized scale of irritability: "He is not irritable." "He is very irritable." "He is slightly irritable." The data from which the judgments are made may be direct observations of behavior, recollections of past observations, or records of behavior.

Ratings of personality are not new. Casual conversations around a cup of coffee or on the street corner usually include judgments of personality. In one form or another such judgments have been used for centuries as a basis for employing people, making loans, signing contracts, and many other decisions involving people. Recently psychologists have improved the forms by which the judgments are communicated from one person to another. More important, they have computed the reliability of ratings and identified the sources of error, thus making it possible to step up the accuracy of the ratings. The principles of rating personality, which are special applications of the psychology of judgment discussed in Chapter 8, have been profitable to employment managers evaluating a man's worth and also to psychologists who need trait ratings for research on the development of personality. They are of equal value to any honest man or woman who is critical about street-corner opinions and who feels some responsibility about judging other people accurately.

Personality judgments may be communicated in several forms. One is the simple declarative sentence. "Old King Cole was a merry old soul." "Istel is, of course, a fanatic. . . ." Jefferson's letter is composed largely of this kind of straightforward evaluation. Now everyone is merry once in a while, but since the poet took the initiative in calling the king merry, the reader assumes that the king is distinguished in this respect, that he is consistently merrier than the average. Unlike the others, this kind of communication can be used for individual as well as common traits. This is the conventional method of biographers.

Another form is the *check list*. Check the terms that apply to George Washington: active _____, rigid _____, humanitarian _____, taciturn _____, cultured _____, judicious _____, fluent _____, conventional _____. Now everyone who is alive is active, but we assume that this trait is checked only if the subject is more active than the average.

Sociometric methods, described in Chapter 10, are a special way of obtaining ratings of popularity in a small group.

The rating scale is a common device for recording judgments about personality traits. The rater may make his ratings on a scale of five categories, such as A, B, C, D, E, or perhaps one of nine categories, such as 1, 2, 3, . . . , 9. One end of the scale, e.g., 9, is designated as maximum irritability and the other end, e.g., 1, as minimum irritability. The mid-point of the scale, e.g., 5, may be considered average irritability. If we judge presidents as to humorousness on a scale from 1 to 9, Washington would rate about 4 and Lincoln about 8. How would you rate Kennedy _____, Truman _____, Eisenhower _____? Sometimes ratings are made on a scale described by adjectives, such as: Very submissive, Submissive, Dominant, Very dominant. A graphic form of the rating scale uses a line marked Low and High which the rater can mark at any point: Low _____ √ _____ High. In fact much ingenuity and salesmanship have been spent on the design of rating scales and the sheets of paper on which they are printed. However, the difference between good ratings and bad is not the appearance of the scales but the accuracy of the judgments behind them.

When we look into the reliability, or accuracy, of ratings, the most common measure is the agreement between raters. If the purpose is to describe personality in terms of the impression that one person makes on others, as in rating such traits as masculinity, friendliness, sociability, and dominance, the question of reliability is principally a question of sampling: Did the subject make the same impression on one judge in one sample of situations that he made on another judge in another sample of situations? When 20 people are rated as to masculinity by two judges, the agreement between the two sets of ratings can be measured by the correlation coefficient. If this correlation is .70 or better, we can say that these people impressed one judge about the same as they impressed the other, so each judge must have observed fairly good samples of their social behavior and we can have some confidence in the ratings. Likewise, when two psychologists analyze a diary and rate the writer's values or interests, the agreement between the psychologists can be measured in the same way.

But if the purpose of the ratings is to predict future behavior, such as success on a job or adjustment to community life after release from prison, we need a criterion of success and information about predictive validity, as for the ability tests discussed in the preceding chapter.

The main factors that influence accuracy of ratings are summarized in the following eight principles of rating. These are useful principles to know, whether one is being rated as an applicant for a job, whether one is rating someone else, or whether one is listening to one person's informal judgments of another.

Principle 1. Accuracy increases when the trait to be rated is defined. This is an obvious point, but it is still possible for two people talking about Mrs. De Giacomo's adaptability to be talking about different things. When two judges of personality adopt the same definition of a trait, their agreement improves. Similarly, when ratings are communicated to a third party, they are more useful if the third party uses the same definition that the raters used.

Principle 2. Accuracy increases when the rating scale is defined. If a rating scale from 1 to 9 is used, the raters and all using the ratings must understand what the numbers mean. Usually the middle number, in this case 5, means the average amount of the trait, 4 means a trifle less than the average, 6 means a trifle more than the average, and so on. But the average of what sample? When judging someone's sociability, it makes a difference whether the judge rates him in respect to the population at large, or a group of salesmen, or a group of machinists. When Jefferson said that Washington was embarrassed if called on for an opinion, did he mean that he showed more embarrassment in such a situation than the average American of the 18th century or more than one would expect of a successful Virginia planter?

When ratings are collected from several judges, it often turns out that one judge systematically gives ratings that are higher than the others, presumably because he is using a different rating scale. Under these circumstances his ratings can be adjusted, perhaps by simple subtraction, to the scale used by the other judges.

Most judges like to give compliments and hesitate to be critical. When a scale of 1 to 9 is used for ratings of a desirable characteristic, e.g., industriousness, the average of a collection of ratings is likely to be 6 or 7 rather than 5, and the interpretation of the ratings has to be adjusted. This tendency to compliment can be reduced if the scale is properly defined at the middle and at each end.

The graphic rating scale for dominance on the next page attempts to profit by Principles 1 and 2. Such scales are usually printed vertically, for typographic reasons. Rate one man and one woman whom you know well by putting their initials in the appropriate squares.

Principle 3. Accuracy increases with the number of judges. This is a general principle of measurement. If someone tells you that Mrs. De Giacomo is cranky, it may not mean much. But if four people call her cranky, you are convinced. If one rates her 9, another 7, another 6, and another 7,

<input type="checkbox"/>	Tries to bully everyone
<input type="checkbox"/>	Pushes people around unnecessarily
<input type="checkbox"/>	Takes the initiative in a social group
<input type="checkbox"/>	Can take the lead and can follow
<input type="checkbox"/>	Waits to be asked
<input type="checkbox"/>	Keeps in the background on social occasions
<input type="checkbox"/>	Always defers to others' wishes

the average of these ratings is probably more accurate than any single rating. In fact, if all judges are equally accurate, the accuracy of the average judgment increases as the square root of the number of judges.

Principle 4. Accuracy increases as the ratings approach direct observation of behavior, and, in reverse, accuracy decreases as the judge adds more inference to his observations. At best, ratings are summarized memories of behavior observations. When someone working at the next desk to Jones says that Jones is distractible, this statement is probably based on direct observation in the past. When he jumps from this observation to the inference that Jones is worried about his wife, the possibilities of error increase. In general, judgments of specific acts are more dependable than judgments of abstract qualities. Judgments about motivation are particularly subject to error.

The advantage of keeping ratings close to actual observation is illustrated by the Vineland Social Maturity Scale, a useful instrument for comparing children in social development.⁶ The child's mother is asked specific questions about the child's activities:

- Does he ask to go to the toilet?
- Does he initiate his own play activities?
- Does he wash his face unassisted?
- Does he go about the neighborhood by himself?

The first two of these are on the two-year level, the last two on the four-year level.

Principle 5. Accuracy of ratings is reduced by evaluative attitudes. If we ask whether someone is conceited, those who like him will probably say no and those who dislike him will probably say yes. Deciding whether to rate someone "independent" or "very independent" is difficult, and a judge who likes the subject will probably give him the higher rating. Now it is impor-

tant to know whether a man is liked or disliked, but popularity and independence should not be confused.

There are several ways to cut down this kind of error. Acquainting the judges with the error and asking them to avoid it helps some. It may also be possible to phrase questions that are not "loaded." Instead of asking if a man is conceited, one might ask, "Does he talk much about his work?" A more positive aid is the development of an interest in personality. To the extent that a judge becomes intrigued by the structure of his subject's personality and challenged by the task of discriminating one trait from another, his preoccupation with external evaluation decreases. In general, one person's rating of another improves as he learns more about him, but in formal ratings as in casual conversation, statements about personality coming from the subject's friends and enemies must always be taken critically.

Principle 6. Ratings, like other judgments, are often made on the basis of a general impression. Instead of judging each trait separately, the judge forms a general impression of the individual and then rates each trait as it seems to fit this impression. The *halo effect* is a special case of this judgment tendency. When people are rated on several traits at once, statistical analysis usually shows that a person rated high on one trait is rated high on other traits. Apparently the judge is so impressed by an individual that he puts a halo around him and then is so dazzled by its brilliance that he cannot see any weak points. Or the general impression may be bad, so the judge cannot see any good points. This halo effect may be reduced if the judge rates several people on one trait, then later rates them on another trait, and so on, one trait at a time.⁷ But the general impression should not be dismissed as unimportant. In many situations, as when political leaders appraise a candidate's potentiality for winning votes, the general impression he makes may be as influential as any specific trait.

Another special case of this principle is the tendency to judge people on the basis of a stereotype. Someone talks to a young man for a few minutes and gets the impression that he is the bookish type, so he rates him low on sociability and dominance and high on seriousness, achievement motivation, independence, and other traits that he supposes are associated with bookishness. Or he interviews a young woman, pictures her as the schoolteacher type, and rates her high on the traits that he associates with schoolteachers. Many people have stereotypes of ethnic groups and occupational groups and judge individuals on the basis of the stereotypes.

But the stereotype effect, like the halo effect, does not always lead to inaccuracy. The Australian students mentioned in Chapter 10 were most likely to stereotype the nationality groups that they knew best and preferred most. And when American students studied sound movies of different people being interviewed and then rated them, the accuracy of the ratings

was due not only to independent judgments of single traits but also to the tendency to make the same judgments that other judges made.⁸

Principle 7. Some judges are better than others. This fact shows up in all the experiments on judging personality, and when good judges are compared with poor judges, the most clear-cut difference between them is in intelligence. Personality traits are theoretical constructs, generalizations abstracted from specific behavior items, and the more intelligent judges can handle such abstractions better. Social skills and interests are important also. People who have what it takes to attain positions of popularity and leadership are better judges of personality than the average. This does not mean that good judges are sociable. On the contrary, good judges approach people with an objective attitude, oriented toward sizing up the situation and getting things done, rather than socializing. Judges with an objective attitude toward themselves and good insight into their own traits are more accurate in judging these traits in others. Maladjusted people make many errors in judging people.⁹

Principle 8. Ratings improve with training. The best kind of training is that which gives the judge an opportunity to check up on his judgments by comparing them either with objective evidence or with the judgments of others.¹⁰ In this way the most flagrant errors are eliminated. The judge learns, for example, to overlook things that do not correspond with behavior, like physical appearance and names, and to look for useful signs, like characteristic movements, indicators of tension, changes in pitch of the voice, and marks of interest in one topic of conversation rather than another.

When personnel psychologists are asked to improve merit ratings in large organizations, they find that short training courses for supervisors and foremen, teaching them to define the traits and the scales, to avoid evaluation, and to adopt an objective analytical attitude, do actually improve ratings. A learning curve of improvement in judging nursery school children is shown in Fig. 8.19. Under the best conditions ratings attain quite high reliability; under some conditions they are almost worthless.

Performance Tests of Personality

When there is no opportunity for direct observation of behavior and there are no ratings based on past observation or records, a third method is to create an opportunity for observation of behavior. If we are interested in distractibility, for example, it may be difficult to observe people in a sample of distracting situations but we can manufacture distracting situations in the laboratory, put people in them, and see who resists the distraction and who succumbs. If we want to compare people on cooperativeness, we can arrange situations where there are opportunities for cooperation and com-

petition and see who does what. Such arrangements have been called objective personality tests, situational tests, behavior tests, and *performance tests*. In general a standard situation is arranged that calls out various kinds of behavior from different people, and the score is the number of responses of a certain kind or the amount of time spent in this kind of activity. In some cases the score is not a simple count of responses but a rating of some aspect of the observed behavior, and in such cases the examiners need special training and special checks on the reliability of their ratings. An individual intelligence test, like the Stanford-Binet, is administered in a standardized fashion, so many psychologists use this as an opportunity to rate the subject on persistence, distractibility, and cheerfulness.

A few illustrations will show how the situations are arranged. To test dominance in children we can put two children together with one toy and observe which one has the toy two minutes later. To test for suggestibility we have a person of prestige give hints about what people should perceive or do; then we observe who follows the hints and how far. To test for sociability we can arrange a standard social situation and count the times each person initiates contact with another. Tests of persistence have recorded the time that people continue on unpleasant tasks like standing on one leg, holding an object that becomes increasingly hot, or trying to read unreadable sentences. Tests of cheating can be arranged when the experimenter has control of the whole situation. A performance test of social adaptability in a two-person situation has been constructed of many common interpersonal items: (1) While shaking hands the examiner looks directly at the subject and notes whether he returns the glance. (2) While walking to the examining room the examiner changes pace and observes whether the subject responds to the change. (3) The examiner tries to recall a name and notes whether the subject tries to help.¹¹ Many of the situations that have been devised to study general principles, e.g., of conformity and of aggression, have also been used to study individual differences in such behavior.

Ability tests, group as well as individual, are performance tests of personality in a broad sense; in fact, measures of personality are sometimes obtained as by-products of tests of ability. If someone makes a score above average on information about music and below average on information about sports, these scores tell us about his interests. If we ask people to judge the merits of a collection of jokes, their responses will permit inferences about motivation for sex, status, money, and social approval. The familiar association test can also be used in this way: Which word do you think of when you think of "mother": "work," "fun," "sick," "distance," "shelter"?

It is often necessary to disguise these tests. According to the definition of personality, we want to know, not how sociable our subject is when he is trying to be sociable, but how sociable he is when he is trying to do some-

thing else. Signs of sociability and anxiety are recorded while the subject believes he is being tested for something else. Some printed forms that look like questionnaires about opinions or preferences are actually used as performance tests of personality. Regardless of the content of the statement, the number of YES responses is counted as a measure of the tendency to agree to printed statements. If the responses are made in such categories as AGREE, ?, DISAGREE, the number of ?'s may be counted as a measure of cautiousness. Or the responses that deviate from typical responses may be counted.¹²

Measures of individual differences in physiological functions are also used in the investigation of personality. People have been compared in respect to the indicators of emotion described in Chapter 2, especially blood pressure, heart rate, and GSR. Both the magnitude of the response and the rate of recovery are important. The rate at which certain chemicals are manufactured and excreted has also been used as a basis for comparisons between people.

Performance tests of personality have the advantage that the scores are objective. They do not, like ratings, require judges who are unbiased yet well acquainted with the subjects. On the other hand, they sample only a narrow range of laboratory activities, so the question must always be asked whether the scores from these tests correspond with any activities outside the laboratory. Handwriting is an interesting example. Handwriting is certainly a unique characteristic of the individual, so unique that it can be used legally for identification, but it is such a specialized type of activity that a sample of handwriting does not correlate much with anything except another sample of handwriting.

To check on this question of validity the scores obtained from a performance test presumed to measure a psychological construct, such as emotional control, are correlated with scores obtained by some other method, such as ratings, direct observations, or records of behavior, presumed to measure the same construct. If the individuals who get high scores for emotional control by one method also get high scores by the other method, this correlation is evidence for the validity of both methods of describing the individual. As one example, when college students were asked to read boring material in the laboratory, not knowing that it was a persistence test, those who got high performance scores for persistence were the ones who were rated high on persistence.¹³ Furthermore, persistence scores (time spent on such a silly task before quitting) correlated .30 with freshman grades.¹⁴ Since an intelligence test, which can be given in an hour or so, yields so much information about a person's ability, many psychologists believe that after another 20 years of research we shall have performance tests, which can be given in perhaps four hours, that will yield equally valuable information

about personality. At present, however, we must admit that most of the personality traits identified by performance tests do not overlap very well with the traits identified by the other methods.¹⁵

Personality Inventories

Another way to study personality is simply to ask someone to tell us about himself, or, to be systematic about it, we can print a series of questions for use as a group test. There are many devices of this kind, called questionnaires, paper-and-pencil tests, self-ratings, and *personality inventories*, which ask questions about habitual behavior, feelings, goals, and annoyances. The first two items below might be found on a printed test of sociability, the last two on one of dominance.

Would you rather apply for a job by letter or in person?

Which is more important to you, being true to your ideals or being loyal to your friends?

Do you usually take the lead in directing the course of a conversation?

If a merchant charges illegal prices, do you feel embarrassed about challenging him?

Inventories containing such items have been prepared for a wide variety of personality traits, including interests, values, and attitudes, as illustrated in Chapter 3. Some test only one trait; others yield scores for several traits, which may be graphed as a profile. The responses are usually in true-false or multiple-choice form so the test can be scored by anyone with a little training, or even by a machine. When the test has been given to a large number of subjects, it is analyzed and refined by the item-analysis procedures described in the preceding chapter for ability tests. Norms can be obtained in the usual way.

Assembling a questionnaire in this way seems like a straightforward and convenient method for the study of personality, and, in the past 30 years, many such questionnaires have been constructed. But after years of research, it turns out that this method is not so straightforward as it seems—for reasons discussed in earlier chapters. We have seen that when a person is asked about himself, his replies are influenced by fear of social disapproval. Since many of the items on personality inventories are obvious, he can usually guess their significance and fake the answers—if there is any reason to do so. Most people fake in the socially desirable direction, of course, but a few fake the other way. To try to avoid this difficulty many modern personality inventories eliminate items that have socially desirable responses or require a choice between two desirable responses, or two undesirable responses. More subtle distortions occur also because anyone reporting on himself is influenced by his self concept and his self ideal. A person who, according to observation, does “usually take the lead in directing the course

of a conversation,” may answer no to this question because his ideal is to take the lead all the time. A secure person may report more anxieties than the average because he is not afraid to face the truth about himself.

For all these reasons we cannot take the scores obtained from personality inventories at face value. The value, or, to use the technical term, the validity of these scores is determined by the procedures described in the preceding chapter for the validity of ability tests. If a personality inventory is to be used for selecting employees, its predictive validity is determined by correlating the scores with subsequent criteria of success on the job. Interest tests, for example, have some validity in predicting academic success and occupational success, presumably because they reflect stable individual differences in motivation.

Personality inventories are also used, like the other methods, to describe people in respect to a construct or trait, as when we wish to say that someone has more anxiety or more independence than the average. To check on validity for this purpose we correlate the scores with the scores obtained by some other method intended to measure the same trait. For example, college students who get high scores on an inventory of questions about sociability usually are rated above average on sociability by their peers. Those who score high on a dominance inventory show above-average dominance behavior when observed in a social situation. In general, personality inventories are not as good as they appear at first glance, but a few have proved their usefulness in special situations.

One large-scale investigation of eminent scientists in biology, physics, and psychology will illustrate the kind of information that can be obtained from a carefully constructed personality inventory.¹⁶ About 300 men in these fields, selected by their colleagues as successful teachers, administrators, or researchers, were persuaded to take a standardized test of 16 common personality traits. These prominent scientific men were similar in most respects—they were well above the norms of the general population, for example, in intelligence, emotional control, and freedom from anxiety—but the three groups also showed some differences. Those who had made their reputations in research were more dominant, more independent, and more socially withdrawn, according to this inventory, than those who had made their reputations in teaching or administration. The administrators were more concerned about social norms, had more emotional control, and were less radical, as one might expect, than either the teachers or the researchers.

Projective Tests

Since the methods thus far mentioned often need disguise and since the description of personality that they offer may seem superficial, a class of methods called projective has been developed. They are called *projective*

because the test material is vague or ambiguous and the instructions encourage the subject to interpret the material in his own way, that is, to *project* his personality into the task and respond according to his own motives, emotions, and habits of perception and thought. Thus different subjects make different responses and the examiner studies these in order to make inferences about personality.

One widely used test of this kind is the Rorschach test, which consists of 10 inkblots like that of Fig. 5.15. The subject is asked to look at each and tell what he sees. Some people respond to little details and some respond to the whole pattern. Some give many unusual responses and some give conventional responses. The examiner counts certain kinds of responses and rates the subject in comparison with other subjects on common traits, or, from experience with many subjects, the examiner builds up a general impression of the subject's personality and writes a report about him, including individual traits as well as common traits. The following interpretation was written by an expert examiner about a college graduate, male, about 30, referred for examination before undertaking prolonged psychotherapy.

The Rorschach record of this man projects a somewhat better than average, though not superior, mentality. He is very ambitious intellectually and is striving to achieve to the maximum, if not beyond, of his capacity. The thought processes exhibit a proclivity for excessive generalizing and theorizing. The theoretical constructions are more frequently characterized by vagueness and inexact perceptions rather than careful elaboration and combination of factual data, but there are no serious departures from accepted ways of thinking.

Outstanding in this record is the patient's immature emotionality. Despite his attempts at control emotionality emerges along egocentric lines. Efforts to utilize his emotions in a socially acceptable and constructive manner in rapport with people about him are weak and unsuccessful. His defenses against the egocentric emotionality, some aggressiveness and hostility, take the form of fantasy, repression, and some self-directed punishment which results in feelings of gloom and possible depressed moods of a transitory nature.

At the basis of his immaturity is the indefinite and confused sexual identification. He is not clear about the differentiation between the sexes; e.g., in one instance he sees "Two men-dancers . . ."; a while later the same percept is converted to women because of the ". . . breasts, high heels, etc." In another instance bulls' heads are seen and the perception of a cow's head immediately followed. There is some evidence that this man's relationship with the father was very disturbing and did not allow for an adequate psychosexual development.

This man's ego shows adequate strength and good control. There is some anxiety present, but his defenses (mentioned above) seem to bind it to a fair degree. As to psychotherapy, there is a question whether there is sufficient manifest anxiety and capacity for rapport to enter into a deep therapeutic

relationship. If a great deal of uncovering is done (which may be difficult) some immature outbursts and abnormal behavior patterns may be brought about.¹⁷

Another widely used projective test is the Thematic Apperception Test or TAT. This consists of a series of pictures which are shown to the subject one at a time with such instructions as: "Tell me a story about the picture. What are the people doing? What is being done to them? What are they thinking?" As we know from previous chapters people seldom describe what they perceive with complete fidelity, so different people tell different stories. In fact the pictures are selected and the instructions are worded so that the subject will project his hopes and fears onto the pictures, and the same dynamic themes will appear in several stories. The examiner then reads the stories and makes inferences about the subject's personality, especially about motivation. These inferences may be in the form of ratings on common traits, such as achievement motivation, or verbal description of individual traits. Here is the story told by one subject, a married man of 25, to one TAT picture, in which a naked man is seen clinging to a rope.

The boy or young man on the rope is a gymnast . . . takes great pride in his muscles and ability. . . . Today some girls came in to see the men working out . . . and this particular boy was doing everything to appear the hero and strong man in their eyes . . . not that he cared particularly to meet the girls . . . it's just that he wanted them to see that he is the best around. While he is doing all this showing off . . . a small, thin chap with glasses . . . and a portfolio joins the girls, and they all turn eyes on the muscular young man. He smiles to himself and he takes a running leap at the hanging rope and shimmies up like Tarzan, and starts doing all sorts of difficult feats, one-arm planches, dislocations, and so on, for about five minutes, and then he looks at the group that were watching him, and sees that they (the girls) are laughing at the little fellow, who is trying to lift a huge weight . . . and being very funny about it. The muscular one comes down the rope, watching as he descends. "Why should they choose to look and laugh with the skinny, scholarly chap, when I was being so sensational!!"

The two chief descriptive themes in this record, as summarized by the psychologist: (1) A young man with great pride in his muscles and ability shows off to girls to impress them as being best. (2) At the same time a thin scholarly fellow makes them laugh, and the muscular one feels the other is stealing the show.

The psychologist's interpretation of these themes: (1) If one shows off with great pride in one's body it is narcissistic more than heterosexual. (2) The girls may prefer a funny scholarly chap.

The psychologist's diagnosis: (1) Great body narcissism; exhibitionism. Little heterosexual interest. (2) Homosexual competitiveness. Great stress on being thought entertaining. Feeling of inadequacy.

The psychologist's clinical notes (based also on this man's responses to other TAT pictures):

This story probably reflects a double identification in that inquiry revealed that the subject thinks of himself both as muscular and, on the other hand, as too little. The other stories, too, show his need to be considered scholarly. His actual appearance was that of a small, inoffensive man, whereas he was a professional athlete. This theme is also related to competition with a brother three years older and has much to do with the patient's homosexual competitiveness with other men rather than genuine heterosexual interest. This man sees people primarily as an audience. . . . The laughter which the second identification figure arouses was one of the patient's most important conscious needs (getting the laughs).¹⁸

The story-completion method, which we have already met in Chapter 3, operates on the same principle but uses incomplete stories instead of pictures.

A drably dressed woman of about forty-five was walking down the street toward the park with a stylishly dressed girl in her teens. As they were about to cross the road, the girl suddenly stopped and turned back. The older woman stopped also, looked back at the girl, and . . .

You finish the story.

The sentence-completion method uses shorter items and more of them.

Finish each of these sentences.

Most people that I know are . . .

If anyone wants to make a living today he has to . . .

If I had my own way I would . . .

The trouble with most women is that they . . .

Men are happiest when they have an opportunity to . . .

Projective tests are like the other tests in that they put the subject in a standard situation with standard test materials and then record his responses. The difference is that the responses to projective tests are given freely, as in ordinary conversation, so they cannot be scored objectively but must be interpreted by a trained examiner. There are rules and collections of previous responses to guide the interpretation, but still the scoring depends greatly on the examiner's skill and to some extent on his own personality.

When projective tests are used for prediction, their predictive validity is estimated in the usual way. For example, college counselors, trying to help students adjust to college life, would like to be able to identify those who will later have difficulties. In one girls' college the Rorschach test was administered as a group test to entering freshmen, 633 girls in all, and from the results each girl's adjustment was rated Poor, Fair, or Good. Ratings of Poor were given to 25 percent of the girls, Fair to 50 percent, Good to 25 percent. Four years later, when records were collected for seniors, 334 had had some kind of difficulty, such as probation, inadequate social life, psy-

chological troubles, or what not, and of these 32 percent had received ratings of Poor when they entered, 49 percent had received ratings of Fair, and 19 percent had received ratings of Good (see Table 12.1). This associa-

TABLE 12.1. Ratings of Adjustment by Rorschach Test at Entrance for Girls Who Had Problems in College and for Girls Who Graduated Without Problems

Adjustment Rating	Girls With Problems	Girls Without Problems
Good	19%	31%
Fair	49	51
Poor	32	17

SOURCE: Data from Schmeidler, Nelson, & Bristol.¹⁹

tion is roughly equal to a correlation of .19. There were 19 girls who showed severe psychological difficulties and withdrew before graduation, and 13 of these 19 had received ratings of Poor on the Rorschach test. Hence this projective test has some predictive validity in this situation, especially for identifying the serious cases.¹⁹

Frequently projective tests are used, not to predict future events, but to help the psychologist diagnose the subject and plan a course of therapy, as illustrated by the Rorschach report printed above, and validity in this situation depends on the psychologist as well as the test. Projective tests are also used as research tools, to compare social classes or cultures in subtle respects that cannot be tested more directly. For example, the story-completion test produces stories that can be scored for number of references to the present, immediate future, and distant future, and, as one might expect, delinquent boys, who have been caught and punished repeatedly, write stories that show less orientation toward the future than control boys of the same education and social status.²⁰ (see Table 12.2).

TABLE 12.2. Time References and Scores for Stories of Delinquent Boys and Controls

Time Reference	Score	Delinquents	Controls
Three months or more	6	1	2
One week or more but less than three months	5	1	6
Twelve hours or more but less than one week	4	8	3
Five hours or more but less than twelve hours	3	4	9
One hour or more but less than five hours	2	6	6
Under one hour	1	6	0
Average score		2.8	3.6

SOURCE: Barndt & Johnson.²⁰

Combinations of Methods

Each of these methods approaches personality from a different angle and each yields a different type of information, so any statement about a personality or about the development of personality traits is more convincing when the method of assessment is specified. Anyone who wishes to understand a person thoroughly should use more than one method. Watch him or her in action, preferably in situations in which you have watched other individuals. Inquire what others think of him. Ask him to talk about himself. It is risky to depend on information based on any single method, but when two or more methods give a consistent description of personality, it can be accepted with some confidence. Serious biographers, likewise, combine the information from different methods whenever possible.

In a clinic or an employment office psychologists often use the *interview* to ask standard questions like those that appear on personality inventories, or they may operate more casually, letting the subject describe himself in his own frame of reference with his own inhibitions. Some use the interview as an informal projective device, dropping a few ambiguous hints and letting the subject take the conversation wherever his fantasies lead him. Usually they listen carefully, observe signs of tension and relief, and make ratings of social interaction, interests, conflicts, and defenses. They often use this situation also to collect facts about previous behavior and to administer psychological tests.

When people are to be studied thoroughly, as in the longitudinal studies to be discussed soon, many types of information from various methods are collected and filed. Ten years later the researchers may pull out the file and use all the information to make ratings of personality at age 6 for comparison with personality at age 16.

All this does not mean that the collection of large amounts of information guarantees accurate assessment of personality. In one large-scale assessment of postgraduate psychology students ability tests and interest tests had some predictive validity, but adding projective tests and interviews to these made no improvement.² And in a study of the social behavior of children two observers watched children and rated them with 88 percent agreement, but when they rated other children after long interviews with their mothers, the agreement was only 68 percent.¹⁰

PRACTICE PROBLEMS

Here is a brief sketch of an interesting character, condensed from a recent history of American politics.²² Read it and be prepared to answer questions about his personality.

A well-educated Irish-born lawyer, Ignatius Donnelly came to St. Paul from

Philadelphia in 1856 to found a model community at Nininger. After it was wiped out in the panic of 1857, he went into farming and Republican politics. Republican victories in 1859 and after made him lieutenant governor and sent him to the Senate for six years, but he broke with the party machine and was beaten in 1868. . . .

Donnelly's first campaign as an independent was for tariff revision. Unsuccessful as a candidate on this issue, he came back to the Republicans in 1872 as a Liberal supporter of Greeley. After the hard times of 1873 he became chief lecturer for the Minnesota Grange, pushing the Grange more and more into politics until he finally persuaded it to back an antimonopoly party that, while it failed to elect him governor, did send him to the legislature. The thirteen reform bills he introduced, some of them unreasonably wild, all failed, and the slow death of Grangerism and the antimonopoly parties soon sent him back to private life. . . .

It was hard to keep a man of Donnelly's resilience from bouncing. In 1881 Harpers brought out *Atlantis, The Antediluvian World*, his popularly written attempt to prove the existence of Plato's lost continent in the Atlantic. . . . *Ragnarok: The Age of Fire and Ice*, followed in 1883, an almost automatic success, and Donnelly took to the lecture platform. In 1884 he tried once more for the Senate, this time as a Democrat, with no better luck than before.

But the Farmers' Alliance was growing in Minnesota, and by 1886 it carried considerable weight in state politics. Donnelly, seeing the bandwagon coming, wanted to ride, but an argument with Alliance leaders over whether to work with the Democrats or the Republicans set him to organizing a reform third party of his own. It elected him to the legislature, where he made a deal with the Republicans and became the most powerful farmer-labor leader in the state. The appearance of *The Great Cryptogram* in 1888, a book that stirred up the famous controversy over Bacon's supposed authorship of Shakespeare, made his name a household word. He lost his legislative seat that same year, however, by refusing to co-operate with the new Union Labor party and turned his organizing talents to the Alliance. . . . The Alliance put him in the legislature again, and the echoes of the People's party campaigns of 1890 in Nebraska and Kansas found him listening.

Pugnacious, learned, a brilliant and persuasive speaker, Ignatius Donnelly stood ready in 1890 to lead the Midwest revolt. He loved to battle for a cause, and he needed one. . . . True, he was inclined to scatter his shot, and to toy with the lunatic fringe. He was too much of an individualist to work well with a group, and he was inclined to play the prima donna if brooked. But he had, to his credit, a deep sense of justice and an affection and respect for the people's will, beside a brain to go with them. "The only politics worth studying," he once said, "is the amelioration of the conditions of the great mass of mankind."

15. Which of the four ratings shown in Fig. 12.5 refers to Ignatius Donnelly?
16. Which of the four value profiles in Fig. 12.6 is Donnelly's?
17. Which of the profiles of Fig. 12.7 is Donnelly's?
18. Mr. A tells us that Mr. B is personable. According to Principle 1 the usefulness of this communication can be increased by asking Mr. A (a) what is his relationship to Mr. B; (b) what kind of behavior he calls personable; (c) to divide per-

sonability into five categories; (d) how many people he knows who are personable.

19. According to Principle 2 the usefulness of this communication can be increased

	A	B	C	D
Aggressive	✓			✓
Callous		✓	✓	
Competitive	✓		✓	✓
Considerate				✓
Diplomatic	✓	✓	✓	
Dull	✓			
Flexible	✓	✓		✓
Hearty				✓
Industrious	✓			✓
Intellectual		✓	✓	✓
Judicious	✓		✓	
Persistent				✓
Progressive		✓		✓
Selfish	✓			
Shy			✓	
Timid		✓		
Weak	✓		✓	
Withdrawn		✓		

Fig. 12.5. Ratings of four men on a check list.

22. According to Principle 5, Mr. A's rating of Mr. B is questionable if (a) A has rated many people like B; (b) A knows many people like B; (c) A was once discharged from a job by B; (d) B has previously rated A.

23. Principle 2 for ratings is analogous to what for objective tests? (a) Use of norms; (b) objective scoring; (c) item analysis; (d) reliability coefficient.

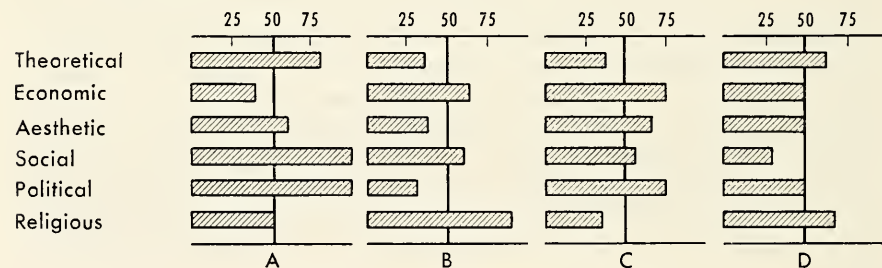


Fig. 12.6. Four value profiles.

24. What is the best evidence that Principle 6 does not apply to Jefferson's judgment of Washington?

- J. states that W. was "incapable of fear."
- J. states that he knew W. "intimately and thoroughly."
- J. mentions W's failures.
- J. refers to W's officers' statements about him.

by asking Mr. A (a) what average personability is like; (b) if people are consistently personable; (c) what is the opposite of personability; (d) how he thinks Mr. B should act.

20. Suppose Mr. B has been rated by Mr. A and three other men, and you have their average rating. If you want to double the accuracy of this average how many more ratings of Mr. B are necessary?

21. According to Principle 4, Mr. A's statement about Mr. B can be made more useful by asking Mr. A (a) how Mr. B is regarded by his associates; (b) how often he has observed Mr. B closely; (c) how common personability is in the general population; (d) to describe what Mr. B does.

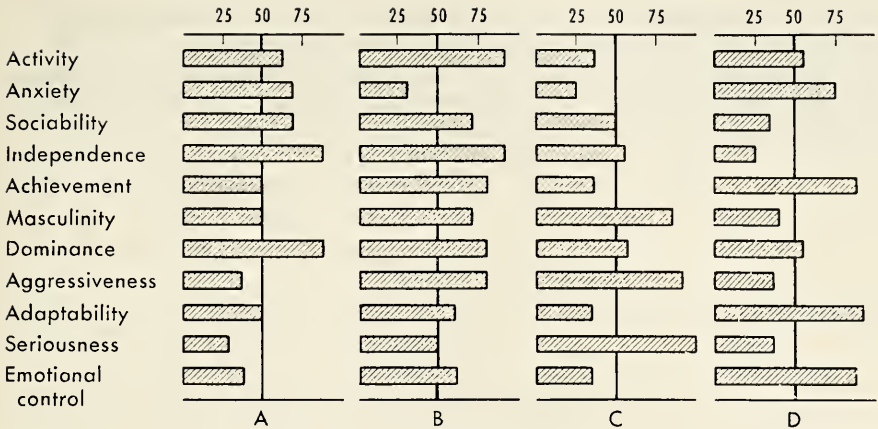


Fig. 12.7. Four personality profiles

25. Putting Principle 7 together with Jefferson's sketch, rate Washington as a judge of personality: very poor, poor, average, good, very good.
26. The question "Do you often feel worried for no particular cause?" belongs on an inventory that tests which trait? (a) Anxiety; (b) sociability; (c) independence; (d) adaptability.
27. The statement "I limit my acquaintances to a select few" belongs on a test of what trait? (a) Anxiety; (b) activity; (c) sociability; (d) seriousness.
28. The statement "I often act on the spur of the moment" belongs on a questionnaire about which trait? (a) Aggressiveness; (b) adaptability; (c) masculinity; (d) emotional control.
29. The question "Are you inclined to stop and think things over before acting?" belongs on a test of what trait? (a) Achievement; (b) dominance; (c) aggressiveness; (d) seriousness.
30. The question "Does tea keep you awake?" belongs on a test of what trait? (a) Anxiety; (b) independence; (c) seriousness; (d) emotional control.
31. What trait does the question "Do you usually do your planning alone, without suggestions from other people?" refer to? (a) Activity; (b) anxiety; (c) independence; (d) achievement.
32. What trait does the question "Are you easily rattled?" refer to? (a) Activity; (b) emotional control; (c) anxiety; (d) seriousness.
33. A girl whom we shall call Miss A was asked by a psychologist to take a personality inventory and mark each statement + or - to indicate whether it was true for her, or false. Then she was asked to go through it again and mark each statement + or - to indicate whether it was true for her ideal self, or false. Another girl, Miss B, did the same, with the following results:

	Miss A			Miss B	
	Self	Ideal Self		Self	Ideal Self
1.	+	-		+	+
2.	+	-		-	-
3.	-	-		+	+
4.	-	+		-	+
5.	-	+		-	-

If all the questions were answered as these five were, which girl is happier?

34. Which question gives the least information for this comparison?
 35. John rated himself on a personality inventory and then answered the questions as he thought his father would. Albert did the same, with the results shown below.

	John			Albert	
	Self	Father		Self	Father
1.	+	+		—	+
2.	+	—		—	+
3.	—	—		+	—
4.	—	—		+	+
5.	+	+		+	—

If these five answers are typical of all answers, which statement below is the most accurate?

- John identifies with his father more than Albert does.
 - John is better adjusted than Albert is.
 - John is more self-consistent than Albert.
 - Albert has a higher self ideal than John.
36. Here are two completions written by college students to the incomplete story about the "drably dressed woman." Which shows the most projection?
- . . . followed after her. It seems the young girl had forgotten to buy the latest issues of *Vogue* and *Mademoiselle*, which, of course, all young girls in their teens should have. These magazines have done wonders in helping young girls to achieve the chic modern look of the twentieth century. Even if mothers are forced to go around in rags it is most assuredly worth it.
 - . . . started after the girl. When she caught up with the girl, she asked where she was going. The girl said that they had made the wrong turn a block back and the show was in a different direction.
37. Which of these two is projecting most?
- . . . she too turned back and followed the young girl. When the woman caught up with the girl she inquired what was her object in turning around back. The young girl then proceeded to tell the woman, who was her mother, that she had neglected to turn off the iron and was afraid that there would be a fire.
 - . . . continued on her way. She knew her daughter would be ashamed if one of her girl friends was to see her mother so drably dressed, even though she had just returned from helping a neighbor plant her flower garden. Teenagers had such strange ways about them.
38. Which of these two shows the most anxiety?
- . . . she proceeded across the street. As she walked across the street she was thinking why the girl had left. When she reached the other side, she looked back and watched the girl disappear around a corner. The broken-hearted lady wondered why her daughter had insisted on leaving her alone, and gone to seek better things in the world.
 - . . . continued across the road with a faint smile on her lips, remembering how she was often forgetful when she was young, and in love. She half wished that she were young and attractive again, but shrugged her shoulders slightly and continued on her way to the park.

39. Which method of assessment is illustrated by the usual road test for automobile drivers?
40. The road test has been criticized for several reasons. Which two are the most serious weaknesses? (a) Inadequate sampling of behavior; (b) inadequate definition of trait; (c) no disguise; (d) inaccuracy of observations; (e) inaccuracy of ratings.
41. What trait is tested by this item?
- arrow
- ribbon
- Underline the word that goes with bow
42. Under what conditions would personality ratings have low validity although the different judges agree with each other?
- The rating scale is inadequately defined.
 - The ratings are made on the basis of a stereotype.
 - Some judges are more prejudiced than others.
 - The ratings are made at different times.
43. Chapter 8 stated that all judgments are relative. Which principle of rating personality is based on this generalization?
44. A teacher asks a child's mother if the child is independent at home. Which error is most likely to influence her reply?
- Mother's rating of her child is based on too small a sample of behavior.
 - Mother's ratings are too far removed from actual observations.
 - Mother lacks norms for comparing her child with others.
 - Mother confuses independence with sociability.
45. Table 12.3 shows how two teachers, A and B, ranked six children in respect to sociability and anxiety. On the basis of these results, which trait is harder to rate? (Hint: Compute two correlations.)

TABLE 12.3. Ranks of Six Children on Two Traits by Two Teachers

	Sociability		Anxiety	
	A	B	A	B
Mary L.	3	3	2	4
Eugene K.	2	1	4	2
Henry C.	1	2	1	1
Mary H.	6	5	5	5
Ted W.	4	6	3	6
Kenneth W.	5	4	6	3

DEVELOPMENT OF PERSONALITY

Now that we know how personalities are described, we are in a position to ask about the origins of personalities. Why are some people more active than others, or more anxious, more masculine, more sociable than others? Obviously there is no single answer, so we have to consider several kinds of influences on personality development, beginning with biological influences. Many of the facts and principles of preceding chapters will be helpful here.

Biological Factors in Personality

One should never forget that man is an animal. His eating, drinking, and mating, even his birth and death, are much like those of the other mammals. When we ask why one personality is different from another, the answer is to be found, in part, in the biological constitution of the individual, which comes to him largely as an inheritance from his ancestors, tax free.

Heredity. In all probability some of the differences between one person and another are of hereditary origin, particularly those directly dependent on the functioning of nerves, muscles, and glands, but, because of the difficulties of studying human heredity, noted in the preceding chapter, little good evidence is available. Identical twins brought up in different environments are instructive here, as in the study of inheritance of abilities. One such pair was separated when they were two weeks old and adopted into separate families. Adelaide traveled widely up to teen age; consequently her schooling in these years was irregular. Her foster parents believed in and practiced strict discipline. Beatrice's residence, in contrast, was quite stable, and she enjoyed a milder sort of discipline, constant companionship with both foster parents, and effective guidance from one of her high school teachers. She was ill for six months, however, during her fifth year. Psychologists observed and tested the twins several times up to age 18 in order to estimate the effects of these environmental differences on twins of identical heredity.

It turned out that, although they were educated in different schools, their speed and style of handwriting were quite similar. Their careers were similar up to age 12 in respect to nail biting, enuresis, and early puberty. They were alike in mannerisms such as in walking and shaking hands. At summer camp their leaders rated them about the same in physical vitality, irritability, and a tendency to be dissatisfied. Despite differences in home and school, their interests at age 18 were similar. The chief difference noted, which must be environmental, was in social traits, for Beatrice, whose home situation contained less pressure, was rated more cheerful and showed greater warmth and skill in social relationships. A similar environmental difference was observed in the twins mentioned in Chapter 11: the one with little education was ill at ease in social situations, while the other was poised.²³

To get more comprehensive evidence on this question broader samples and more comparisons must be made. A standard personality inventory was given to pairs of identical twins, pairs of fraternal twins, pairs of brothers and sisters, unrelated children living together, and children of the general population in an attempt to sort out the variance due to environment and that due to heredity. For example, the variance between identical twins is

due to the environmental difference within the family. The variance between fraternal twins is due to this environmental difference plus the hereditary difference between fraternal twins. The variance in the general population is due to the maximum environmental difference plus the maximum hereditary difference. It is possible to make several equations of this form, and those who remember their college algebra will know that one can determine several unknowns from a set of simultaneous equations. This investigation indicated, in a preliminary way, that some traits, like activity and dominance, depend considerably on heredity, while others, like emotional control and conformity, are mostly environmental.²⁴

Physique and Personality. Although it is difficult to disentangle the influence of heredity from that of the environment in the formation of personality, it is fairly easy to compare personality traits with constitutional traits, such as body build, which are largely hereditary. Hence blonds have been compared with brunets, and fat people have been compared with thin people, but clear-cut associations between body structure and personality have not been found.

These facts are well known, yet many writers, when describing someone, refer to "an honest face," "laughing eyes," or "an impertinent nose." If these observations are worth while, they are based on habitual facial movements, not facial structure. More likely, they have been fastened on the face after they have been derived from other sources. (Does Taylor, in his description of Istel, fall into this error?)

It is dangerous to judge personality from physical appearance. The young lady with the cheerful lilt to her mouth, who looks as if she were about to break into a smile, may actually smile oftener than the average young lady, but then she may not. Perhaps her mouth is built that way. Or it may be a trick in the way the lipstick is applied. The wise judge of character will not depend on facial structure but will wait until he sees the smile.

Biochemical Factors. Consistent differences in amount of activity are noted in the first weeks of life. These differences may be due to heredity, to differences in the intra-uterine environment before birth, or to the birth process itself, and they may persist into adult life. In adulthood we know that the activity of any one person at different times is influenced by drugs, amount of oxygen in the blood, alcohol, fevers, and diet, so one would suspect that differences between people in activity level could be traced to such biochemical factors. This hypothesis has been verified in some extreme cases at least. *Hyperthyroid* people, with their metabolism speeded up by an abundance of thyroid secretion in the blood, are characteristically overactive, excitable, and apprehensive. *Hypothyroid* people, with their metabolism bogged down to the point where they actually use less oxygen than normal people, are typically slow, dull, and careless. Both types of thyroid disorder

can be treated by endocrine therapy or surgery with good probability of recovery, and with recovery comes a dramatic return in many cases to the former personality.

This relationship between thyroid function and activity level cannot be reversed. If we begin with normal children and compare those rated high on activity with those rated low on activity, no difference in metabolic rate is found. Within the normal range of thyroid function differences in activity level are due to other factors, perhaps social factors or other biochemical factors not yet known.

Sex hormones in the blood also play a part in personality, particularly in respect to general activity or alertness, sexual activity, and masculinity. Boys with male hormone in the urine are more adult in their interests than other boys of the same age.²⁵ Like thyroid function, this influence shows up most clearly at the extremes, as when a boy is castrated before puberty or when puberty is abnormally delayed. In these rare cases, if the missing hormones are restored by medical treatment, personality changes usually follow.

Usually biochemical and social forces work together; a baby is diagnosed as a girl so she is treated as a girl and learns the feminine social role. But occasionally mistakes are made. One case was considered a girl at birth, dressed as a girl, and brought up in a feminine way. But to others it appeared that she was a tomboy at heart, who preferred baseball to sewing. When her (or his) beard became embarrassing, medical examination changed the diagnosis. Despite acceptance of his role as a girl, and training as a girl, he developed masculine interests, told the physicians that he would rather be a boy, and when tested on a variety of personality tests scored nearer to the average male than to the average female.²⁶ In this case, the only one studied so thoroughly, with objective comparison with male and female norms, the masculine biological forces broke through the years of feminine learning. If endocrine changes, such as those associated with castration and sterilization, occur during adult life, after sexuality is established and the personality is well learned, the effects on personality are quite small.

It would be easy to exaggerate the importance of biological factors in personality, especially if one were sitting in a waiting room of a clinic for endocrine disorders. These medical cases make fascinating reading, but when one leaves the clinic to go out and walk among healthy men and women, the significance of biochemical and neurological factors dwindles. It is true that hyperthyroids are usually hyperactive; but most hyperactive people are not hyperthyroid. It is true that hermaphrodites are prone to homosexuality, but hermaphrodites are extremely rare. Among homosexual people in general 95 percent are no different biologically from their more orthodox neighbors, as far as present tests can detect. We know, from the

discussion of homeostasis in Chapter 2, that there are many automatic mechanisms for keeping the body in a stable chemical condition. As long as these conditions are maintained within the normal range of variation, the direct consequences of biochemical differences between individuals are likely to be small. (In some environments biological variations may initiate a learning process that influences personality indirectly, as we shall see in the next section.)

Intelligence. General intelligence, which as pointed out in the preceding chapter is partly a biological factor, influences the development of personality less dramatically but more thoroughly than do the glands. The most intelligent quarter of the population live in a psychologically different world from the world of the least intelligent quarter. They take in more facts at one time, and they interpret the facts more accurately. They absorb more education; their interests are more intellectual, particularly reading interests. As they learn their personalities, in ways to be described, they learn the more abstract aspects of the culture, which pass by the lowest quarter, and they are more critical about what they learn. Of the known biological factors this is probably the most influential in the development of normal personalities.

Learning Personality Traits

Personality depends on both heredity and environment, or, to put it more dynamically, develops by the interaction of maturation and learning. Thus the principles of learning, presented in Chapters 6 and 7, will help us here as elsewhere. In general, children acquire behavior that is rewarding and avoid unpleasant things like punishment. The environment of one child rewards a certain kind of behavior more than the environment of other children and this behavior generalizes to many situations and thus becomes a consistent habit or trait that distinguishes this child from others. But learning personality traits is not as simple as learning to swim or to spell; hence some general principles of personality learning should be pointed out before we turn to the learning of specific traits.

In the first place, a child does not practice personality traits like independence and masculinity—at least a young child does not. He learns these traits by what Chapter 6 called incidental learning, learning while doing something else. He may practice swimming intentionally, and success in this activity may indirectly increase his independence, but it is the swimming that he practices. The influence on independence is a by-product as far as he is concerned.

Also, the learning of personality traits is greatly influenced by social interaction. The rewards and punishments are administered by parents, teachers,

and other children most of the time. Such social processes as instruction (also called training, discipline, and teaching), imitation, identification, and rejection will appear often in the pages to follow.

Furthermore, the learning of personality is complicated by the possibility of reaction. If Mother makes Genevieve practice swimming constantly, Genevieve may develop interest and skill in swimming, but not necessarily. She may react against swimming, tennis, and all such activities, and against her mother too. Or someone may react to a physical handicap by acquiring above-average interest and skill in swimming. It is probably true that most personality learning is motivated by positive rewards, but some portion of the personality begins as reactions against frustration, anxiety, guilt, and physical, intellectual, and social handicaps. Chapter 9 described several reaction patterns, such as aggression, compensation, and projection, any of which may occur only once or twice, but those that occur in many situations and have effects that, in some secondary way, are rewarding are the ones that become personality traits. Temper tantrums are reactions to frustration, which occur occasionally in nearly all children; they persist and become embedded in the personality if they bring some secondary gain, such as a promise of candy or affection. These reactive traits are likely to be peculiar to the individual, that is, individual traits rather than common traits. Thus in later life a trait may be traced back to simple rewarded practice, to learning incidental to something else, to reaction against something unpleasant, or to all of these in complex interaction.

In any event, the parents' attitudes toward child training are critical aspects of the growing child's environment. These attitudes differ from one culture to another and, within our culture, from one social class to another. Middle-class parents, for example, as noted in Chapter 10, put more pressure on their children for educational and occupational achievement. Aside from class differences, families differ in many specific respects. Some parents are pleased by constructive activity; others encourage neatness. Some proud parents want their offspring to know the truth and stick to it; others reward imaginative storytelling. If the parents are successful in their intentions, their children's personalities will differ in these respects when they grow up. We know that there are general characteristics, like strictness, which differentiate one home environment from another because mothers who are strict about one thing, such as toilet training, are strict about other things, such as table manners, being quiet, "talking back," and everything connected with childish sex play.²⁷

Just what traits the parents emphasize depends on the books they have read, the sermons they have heard, their diagnosis of the children's needs, and, of course, their own personalities. The strict mothers, for example, have more anxiety about themselves and their families. Parents' attitudes

toward their children may be slanted also by their reactions to their own childhood. The man who had to work hard as a boy may be determined that his son will also learn the virtues of hard work, or he may plan that his son will enjoy the opportunities that his father missed. A shy, socially inadequate woman may protect her daughter from the cruel world of thoughtless human beings, or she may demand that her daughter acquire more poise than her mother. Furthermore, one parent may train the child not to acquire the faults of the other parent. When the parents' demands on the child come from reactions against their own childhood or from rivalry between parents, one can look for inconsistency in training, vacillating between rigor and sentiment.

The child's acquisition of his personality is influenced not only by parental intentions but also by actual living conditions and parental behavior. One child may grow up in a carefully organized home, run by the clock, while another grows up in a more casual environment. Some parents spend more money than others on their children's clothes, games, and travel. Children do not always generalize about their parents' attitudes, but they observe their parents' reactions to frustration, their eating and drinking habits, their politeness, the friends they bring home, and their conversation. Children notice how well their parents keep their promises, how often they laugh, and what they do in their leisure time, and, as a rule, they take over many of these traits from their parents. For example, by counting the organizations that rural children and their parents belong to, it was found that the social participation of the children correlated about .60 with that of their parents.²⁸

Personality and Early Environment

Sometimes the actual course of development of a personality trait can be observed, as we observe progress in swimming and arithmetic. Better yet, a few genuine experiments have been done, comparing the personalities of those whose environments have been deliberately manipulated with the personalities of a control group. Most of the information in this section comes, however, from correlations between children's personality traits and various factors in the home and school environment where, we assume, they learned these traits. Environmental influences are assessed by asking parents and teachers about their attitudes and methods of handling children or by direct observation. By and large, the recent research attributes less importance to specific events, such as breast feeding and toilet training, than to general influences, such as strictness of discipline, amount of affection, anxieties of parents, and the kinds of behavior expected of the child. This information can be most helpfully summarized in relation to some of the common traits described earlier.

Activity. The simplest feature of the child's environment is the amount of stimulation he receives. Since babies are cute and charming and do not threaten anyone, they are stimulated, tickled, fondled, and jiggled. As one might expect, the only child in a family gets much stimulation and much social reward for response and is therefore more active than children in larger families, and he talks at an earlier age. At the other extreme, babies in institutions, without this "mothering," often do not develop a normal interest in the environment; they remain dull and inactive.²⁹ In later life repeated failure and anticipation of failure probably reduce activity level. These effects of social learning may add to or subtract from the effects of biochemical factors mentioned above.

Dominance. Controlled experiments have demonstrated that dominance can be learned.^{30,31} The experimenters first rated children in nursery school by observing each at play with another child of the same age, noting who got the toys in the sandbox, who bossed the other, and who defended his own possessions. Then they took the children of low and medium dominance and trained them, having them make designs with blocks, put picture puzzles together, learn stories in a picture book, and perform other tricks of this kind, then paired them again with the other children. The experiment worked. Specific training with the objects and techniques involved in the social situation increased dominance and confidence by increasing the child's resources. It is possible also to begin with the dominative uncooperative children and train them to be more cooperative.³² As these children grow older, they have more successes and more failures, more experiences in giving and receiving, hence their dominance, self-confidence, and co-operation may increase or decrease. But adult personalities are not shifted as much by life's vicissitudes as children's are; some of the habits learned in childhood are retained to form part of the adult personality.

At college age research has shown that young men and women who are above average in dominance come more often from families of above-average income and social prestige than from below-average families. Self-confident adults usually give a history of being allowed some freedom and responsibility when young. Dominant women often report identification with the father rather than the mother, who may be remembered as a "weak" character.³³ Overprotection by either parent interferes with the normal development of self-esteem.

Dominance and sex are related in a complicated way. On the average the male of the species, in man, apes, seals, and many other mammals, is more dominant than the female, so this social habit is probably learned in situations where the male's greater size and strength give him the advantage. And masculine women are more dominant than feminine women. On the other hand, dominant women are more interested in sex than nondominant

women and claim more experience at age 25.³⁴ Some of these relationships can be reversed by cultural expectations; in fact among the Tchambuli, a primitive tribe in New Guinea, and among the Burmese, women have relatively high status. In our culture, as everyone knows, women are not so retiring as they were a hundred years ago, and a similar shift is now taking place in Japan at a more rapid rate.

Aggressiveness. Aggressiveness is not an inherited trait. It is learned in home and school, on playground and street. It probably first appears as a reaction to childhood frustrations and then may be encouraged or discouraged by parental reward and punishment. At preschool age aggression is more common in children whose mothers have been both permissive and punishing.²⁷ Discord in the home and inconsistency between parents in their discipline of the child also increase aggressive behavior in nursery school.³⁵

Most families tolerate and even encourage a moderate amount of aggression in boys, a smaller amount in girls. If a boy comes home from a fight with a bloody nose and torn clothes, his father may say, "Well, he is all boy," and ask how the other fellow looks. Not so for his sister. Most boys identify with their fathers and imitate older boys and movie heroes and thus develop masculine patterns of aggressiveness. Boys who do not have fathers at age three and four are not as aggressive as other boys. Girls are more influenced by their mothers, and absence of the father does not affect their aggressiveness at this age.^{36,37}

When aggressiveness goes beyond the social norm, that is, beyond what parents and friends expect, it interferes with ordinary friendly relations. This hostile attitude toward other people is more likely to develop in families where the discipline has been very strict and the children have thus been frustrated and punished often. At school age children from permissive families are less hostile, more friendly and cooperative on projective tests.³⁸ When we go to the extreme and study the family backgrounds of delinquent boys, it turns out that in comparison with non-delinquent boys from comparable neighborhoods, the delinquents come more often from homes that are cold and indifferent, with strict physical punishment. Parents of non-delinquent boys do not ignore their offspring's aggression; their parental control is described as firm but friendly.³⁹

Anxiety. Threats to one's security come from many sources. Anyone whose physiology is easily upset by emotion or who takes a long time to recover is likely to be more anxious than the average. Anyone in a potentially dangerous situation, such as a combat pilot during wartime, or a manager of a company that is losing money, or a woman whose husband drinks too much, is likely to be more anxious than the average. But everyone has adrenal glands and everyone has troubles. The anxiety which a person

carries around with him and which gives a characteristic color to his personality depends largely on his interpretation of the world and of his chances of being overcome by it. At first he interprets the world through the eyes and ideas of his parents. When anthropologists compare child training in various cultures around the world, they find that where there are beliefs that illness is due to wrongdoing and that accidents result from offending a powerful sorcerer, parents are more severe on their children. Apparently this severity makes the children anxious about these unseen dangers and when they become parents, they transmit their anxious view of the world to their children, and so on, from one generation to the next.⁴⁰

In our culture overprotective mothers warn their children constantly about such dangers as sharp knives, strange people, bad dogs, germs, fires, and vitamin deficiencies, so the children learn to view the world as an insecure place to live in. Children who are overprotected do not get much practice in techniques for meeting the rough and tumble of daily life so they are easily threatened by routine events.

Parents who set very high, perfectionistic standards often have anxious children. Most parents treat their children as human beings and expect mistakes now and then. They give affection in spite of mistakes. If parents hold rigid expectations and deny affection when errors occur, the child may adopt these standards and feel anxious about any transgression, such as getting his hands dirty or wetting the bed. Thus the child develops a strong superego. If this continues into adult life, he feels anxious about even thinking of anything mildly sinful. He punishes himself for fancies, dreams, and thoughts that the ordinary person accepts as the price of being human.

To turn some of these statements around, we may say that the secure person has retained some of his natural spontaneity and interest in his surroundings. He has learned some techniques suitable to the range of personal problems in his present situation, and he has learned to expect himself to be somewhat less than perfect.

Independence. Most of the child's early training is in the direction of dependency. He has to depend on others because he cannot do much for himself. All children become more independent as they mature, but some parents push their children into independence earlier than others, either by design or by neglect. Children from permissive homes develop more independence and initiative than children from restrictive homes because they get the help they need from their parents but also because they get practice in solving their own problems.³⁸ The child who does not learn to do for himself remains dependent, but he can also learn to depend on his parents if that is the only way he can get affection from them. Mothers who are annoyed by their children's demands and later give in to them report the most dependency in their children at kindergarten age.²⁷

Controlled experiments have shown that children can be taught to solve their own problems in an independent way. The experimenters picked out 15 children who were immature in the sense of giving up, being depressed by failure, requesting help unduly, destroying things, and making excuses. They gave them special training, starting on easy problems and working up gradually to hard problems. Then, when tested again, none of them cried or sulked at failure, and the degree of interest and initiative had increased considerably.⁴¹

Problems of independence come to a focus at adolescence, when boys and girls are on the threshold of adulthood. Those who reach puberty early, those who have made some pocket money for themselves, and those who have lived away from home find it easier to make the transition to adult independence. Parents who have no interests other than their children often try to keep them dependent. At college age the amount of independence anyone shows is typically a complex resultant of an attraction toward doing things and a rebellion against parental ties.

This is another trait that is related to sex or, more precisely, to social expectations related to sex. Boys, as they approach adulthood, are expected to be independent, vocationally, emotionally, and socially. Because of this new set of expectations the independence shown by men in their 20's has little relation to their independence at age eight. The new pressures do not operate so strongly on girls, and those who were dependent on their parents can still be dependent on their parents, or their husbands, or their employers. Hence the independence of women in their 20's is related to the independence shown by these women when they were eight,⁴² as indicated by correlation coefficients of about .35.

The Self Concept. The most important personality trait of all is the individual's concept of himself, the kind of person he imagines he is. This is not a common trait, of course, but an individual trait. Each person's self is not some degree of what others have but a qualitatively different thing. As noted in Chapter 7, the self concept is learned by the feedback from social interaction, by adopting a social role, and by identification with inspiring models. For the same reason that one picture is worth a thousand words, an attractive model may slant personality development as much as a thousand unorganized rewards and punishments. The youth is rewarded for this kind of learning when he looks at himself and sees his hero.

One of the important features of the parents' attitudes toward the growing child is called *acceptance*, the opposite of which is *rejection*. Typically parents enjoy their children and accept them for what they are. Each child has an identity and a place in the family, some personal belongings, an individuality. Children who are consistently trusted and approved by their parents and allowed to participate in family activities usually develop good

self-control and self-understanding.⁴³ It may happen, however, that the child is not wanted; he is made to feel rejected. Or at least *this* child is not wanted; the parents would have preferred a child who is taller or shorter, lighter or darker, prettier or stronger. Rejection is not the same as punishment, and acceptance is not the same as indulgence. Once the child has organized a self concept, he can begin to discriminate between discipline which punishes a specific act and discipline, such as a threat to send him away, which signifies rejection of him as an individual. If his parents do not accept him, who in the world will? As a rule, children who are accepted by their parents are able to accept themselves and live in peace with their assets and liabilities. Later, it turns out, those who can accept themselves are more likely to accept other people without prejudice.

When a child feels that he is rejected, he may become dependent, trying in the only way he can to get the affection denied him. Others react against the parents and become rebellious, aggressive, perhaps delinquent. Usually they feel insecure, incapable of coping with the world and the people in it, but they may react against this anxiety by a blustering façade. A boy rejected by his father, without a male substitute, may identify with his mother and acquire feminine habits and a feminine self concept. A girl may become masculine in the same way, by identifying with her father or some other admired male, and develop masculine habits and interests.

The self concept helps us to understand why the influence of biological factors on personality is more often indirect than direct. If a girl who pictures herself as a delicate creature is stimulated by the chemistry of her blood into overactivity inconsistent with her self concept, she may deliberately inhibit her activity. If a muscular boy hears himself called a bully and his heroes are not bullies, he may lean over backwards and actually show less dominance than his nonmuscular peers. On the other hand, a biological weakling may compensate by struggling hard to become athletic—and may succeed. It is amazing to see how some handicapped children, accepted by their parents, accept themselves and adjust to a difficult life.

Change and Stability

Personality changes come from within and from without. As children grow bigger, stronger, and more intelligent, they overcome more obstacles. They are treated less like children and more like adults, and they begin to think of themselves as adults. At puberty endocrine changes modify appearance, interests, and, indirectly, the self concept. Some reach puberty considerably earlier or later than their friends of the past five years, so social acceptance may be disrupted. Some boys and girls have been prepared by parents or school for adolescence; to others this is a mysterious phenomenon which

raises anxiety level. Many primitive societies put boys and girls through dramatic puberty ceremonies which emphasize the transition to the adult role, just as the marriage ceremony emphasizes the transition to a new role.

Accidents and prolonged illness may cause personality changes, usually in an indirect way. A child who cannot do what the other children do is treated differently and comes to consider himself different. Some become more aggressive; some retreat. A handicap beginning after 20, when the personality is fairly well formed, has less effect on personality than a handicap at age 10.

Personality changes may occur in school and college as a consequence of changes in status. In grade school boys are impressed by courage and skill in sports, and status depends to a large extent on this kind of success. In college status shifts. Intellectual and political successes are rewarded. Thus a boy who had high status before college may decline in status—or the reverse. Dominance, aggressiveness, seriousness, achievement, and other traits may be modified, as well as the self concept. After college, when these boys leave the ivy-covered walls for the busy world of work, status relationships may change again. The big man on the campus may retain his status, but he may not. The little man may move up. In any event, his concept of himself will change when he gets a job, when he gets married, when he first pushes a baby carriage down the street, when he wins his first promotion, and, of course, if he is given a key to the executives' washroom. If his best friend gets a promotion and he does not, or if he is unemployed for some time, his concept of himself will change again.

Girls' personalities often change at adolescence also. At this time personal attractiveness, skill in dancing, dressing, and other art forms have a major influence on adjustment. Success in love is more important for girls, to be sure, than for boys. After 30 personal attractiveness loses its central position, and success as a mother, homemaker, or gardener gains importance for the married woman, and success in work for the employed. The self concept changes with marriage, motherhood, and other critical events. Housewives whose reports of their behavior correspond well with the role they believe a wife should perform get high scores for optimism and self-confidence.⁴⁴

As one goes through life, watching friends get married and divorced, in sickness and health, in good times and bad, one may be impressed by the changes in their personalities or by the stability they show over the years. One can pick striking examples of either change or stability, but the best overall picture comes from longitudinal studies of large samples. One longitudinal study began in 1935 when young engaged couples, somewhat above average in education, reported their values, interests, attitudes, and social habits by filling out several personality inventories. They agreed to keep in touch with their psychologist, and about 20 years later 176 men and 192

women filled out the same inventories again. The largest change in average scores was an increase, for both men and women, in religious values and attitude toward the church. Both men and women had declined in aesthetic values and in their attitude toward housekeeping. (Remember the first test was given when they were engaged and dreaming of setting up housekeeping in a happy little love nest.) Both men and women had become more sluggish, more careless about their dress, more irritable, and their interests had narrowed. The average woman had become more self-confident. Otherwise, most traits showed no changes in average scores. The individuals, of course, shifted both up and down on these traits. Hence the shifts in averages were rather small.

But the important question is not whether the average of the sample shifts up or down but whether the individuals maintain their relative positions in the sample. If someone is at the 30th percentile of the sample in respect to aesthetic value when they are all in their 20's, will he be near the 30th percentile when these people are in their 40's? The correlation coefficients that answer this question are shown in Fig. 12.8. The average correlation is about .50, but religious values correlate .60 and social values .33. Predictions about religious values at age 45 could be made from scores at age 25 with fair accuracy, but this could not be done for social values. Living through good times and bad, through war and peace, some of these people became more concerned about social problems while others became less concerned,

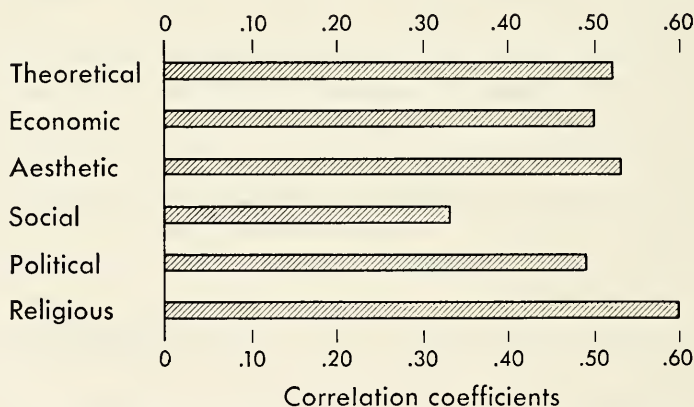


Fig. 12.8. Retest correlations of scores on the Allport-Vernon-Lindzey Scale of Values after 20 years. (From Kelly⁴⁵)

but apparently religious values are more resistant to such worldly events. Fig. 12.9 shows that attitudes toward six aspects of domestic life are quite unstable. After getting married and raising a family some liked "rearing children" much more than when they were engaged and some much less. Vocational interests, as in such occupations as architect, mathematician,

and office manager, were quite stable over this 20-year interval, as indicated by correlation coefficients of around .60. The correlation for self-confidence was .61, for sociability .46, masculinity of interests .66.

Since there were 116 couples in this sample, married for many years, one might ask if husband and wife become more similar in personality as

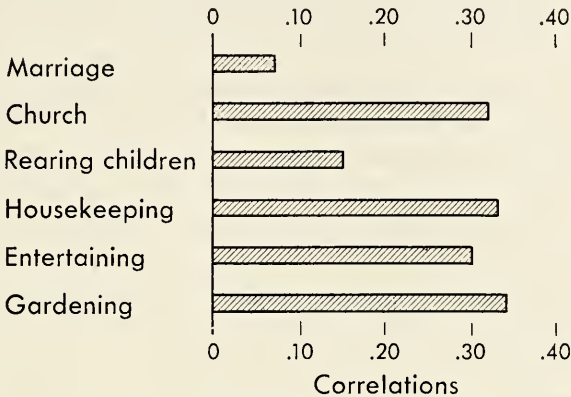


Fig. 12.9. Retest correlations of six attitudes after 20 years.
(From Kelly⁴⁵)

they go through life together. They were somewhat similar when engaged, for “likes attract likes,” but no more similar in their 40’s.⁴⁵

None of these retest correlations is as high as the correlation of .77 for intelligence over a 30-year interval (see p. 420) so we must conclude that the personality traits measured by these printed inventories are not as stable as the intellect. In general the most stable traits are values and interests; attitudes toward specific activities fluctuate with experience in these activities.

All these changes take place, not in isolation, but as part of the pattern of personality. If a man loses his job or has to take a job of less status, it may affect his self-confidence, sociability, and other traits, as well as his self concept. He may begin to think of himself as a failure or as one who has been unfairly treated and develop a set of attitudes to go with this self concept. This may affect not only his degree of sociability but also his specific choices. He is likely to avoid friends who have moved up and seek friends who have dropped down. He may become especially sensitive to symbols of his previous status. He will probably feel anxious about all this and develop some defenses, like those described in Chapter 9, for his loss of status. Commonly there is an unstable period of readjustment, followed by a stable pattern of adjustment that he can live with, that balances the pressures from without and the motives from within. At any moment behavior depends on both the personality and the situation.

SUMMARY

A personality is a complex pattern of human phenomena which, like other complex patterns, can be described by several methods, approaching from different points of view, with different kinds of information; thus the best statements about personality are those that specify the methods used. A literary form, the character sketch, illustrates the variety of facts available and one method of integrating these and communicating a unitary impression. The most frequent unit of communication is the trait, a construct which represents in words some characteristic of behavior by which one individual can be consistently distinguished from another. Many traits have been investigated and, by analyzing the correlations between these, it is possible to condense the information into a small number of standard traits convenient for personality description. Such systems of description refer to common traits, which everyone has in some amount, and are therefore convenient for quantitative comparisons, but individual traits, also characteristic of the person, are described in ordinary sentences.

Since personality is complex, methods of assessment are diverse. People can be observed in action and compared in respect to frequency and type of behavior, including verbal behavior. Records based on past behavior may be available. These may be used directly for comparisons between people, or they may be used as a basis for ratings of traits.

A personality rating is one person's judgment of another communicated to a third. Ratings may be based on any kind of information, but the judge selects the facts pertinent to the traits, as he understands them, and communicates his ratings in terms of a scale of judgment, as he understands it. The accuracy of such ratings improves when the trait is defined, when the scale is defined, when the number of judges is increased, when the ratings approach direct observation, when evaluative attitudes are reduced, when the ratings are made analytically, and when judges correct their errors by checking their agreement with other judges.

Performance tests put people in standard situations where observations can be made under controlled conditions. Tests that appear to be ability tests or personality inventories may be disguised performance tests.

Personality inventories ask people to report their typical behavior, feelings, likes, and dislikes, from which scores can be obtained for values, interests, attitudes, and other traits. Some are obvious and some are disguised.

Projective tests use ambiguous material on which the subject can project his motives, fears, defenses, and typical modes of adjustment. The responses are scored in terms of common traits or interpreted in sentences that describe individual traits.

Each method has its own advantages and special uses. Reliability and

validity are computed by the same logic as that used for ability tests, but the actual procedures are more difficult. In general, information from two different methods is more dependable than information from only one. The interview frequently makes use of several methods.

Heredity influences the development of some of the differences between one individual and another. Biochemical variations, due to heredity or to early environment, may also be influential, especially when beyond normal limits. But most of the differences between individuals are learned—and that is why intelligence is the most important of the biological factors.

Personality learning, which is usually incidental learning, depends on rewards and punishments administered by other people, especially parents, and is motivated occasionally by reactions against other people, especially parents. Parents' attitudes toward child training are influenced by their education and their own personalities and, since their training efforts are sometimes successful, these attitudes are sometimes reflected in their children's personalities. Parents' behavior, expenditures, living conditions, and other objective features of the child's environment also slant the learning of personality traits. From these principles, from observations of the course of development, from correlating environmental events with subsequent personality, and from controlled experiments, it is possible to explain, at least in part, the early development of activity, dominance, aggressiveness, anxiety, independence, and the self concept. The development of these traits differs somewhat between boys and girls because of sex differences in biology and in social role. After 25, basic values, vocational interests, and some general traits, such as self-confidence and masculinity, remain fairly stable, but attitudes toward specific activities change with current events and personal experiences.

PRACTICE PROBLEMS

46. The chief advantage of separated identical twins for research on heredity and environment is that (a) one variable is constant while the other varies; (b) the testing can be done with maximum accuracy; (c) the variables of most importance can be investigated; (d) biological variables can be experimentally altered.
47. Consider two facts: (A) Boys who show male hormone in the urine are more adult in their interests than boys of the same age who do not have male hormone in their urine. (B) Girls who have menstruated are more adult in their interests than girls of the same age who have not menstruated. Why is A better evidence for the direct influence of biochemical factors on personality than B?
 - a. Menstruation is a dramatic event that could operate indirectly on the self concept.
 - b. Puberty changes in girls are more comprehensive than in boys.

- c. Age is psychologically more significant for girls than for boys.
 - d. Boys reach puberty a little later than girls on the average.
48. In one longitudinal investigation of personality development ratings made at age 6 correlated .40 with ratings made at age 15. What does this tell us about the reliability of the ratings?
- a. Reliability must have been low at age 6.
 - b. Reliability must have been low at both ages.
 - c. Reliability must have been fair at both times.
 - d. Reliability must have declined over the nine-year interval.
49. Paragraphs a and b are collections of phrases about sociability, one describing what upper-middle-class parents expect of their young boys, the other describing what they expect of their young girls. Which refers to the feminine role?
- a. Personable, likes new friends; outgoing and extroverted; friendly, a good mixer; gets along well with people.
 - b. Socially well poised; likes to act in front of company; loves to watch people; wants to do what might please people.
50. Family origins of personality traits may be studied by asking each mother to describe her child-training practices and to rate her child's personality. What is the chief weakness of this method?
- a. It puts the emphasis on the unimportant variables.
 - b. It assumes that most mothers are seriously concerned about their children.
 - c. Information about both variables comes from the same source.
 - d. Many mothers do not understand how personality develops.
51. What value are personality traits to a science of psychology?
- a. They help to explain why one individual is different from another.
 - b. They identify the important independent variables of personality development.
 - c. They trace the processes by which personality is acquired.
 - d. They aid the systematic description of personalities.
52. What is the chief limitation of personality traits for the psychology of personality?
- a. They are generalizations, based on averages.
 - b. They do not correlate with the actual behavior of people.
 - c. They do not identify the important differences between people.
 - d. They do not explain anything.

The following character sketch was written in the 17th century by Jean de la Bruyère.⁴⁶ Read it carefully. Try to estimate the interests and values of Giton, and his opinion of himself. Be prepared to answer questions about Giton's motivation.

Giton has a fresh complexion, a full face and bulging cheeks, a fixed and assured gaze, broad shoulders, a projecting stomach, a firm and deliberate tread. He speaks with confidence; he makes those who converse with him repeat what they have said and he only moderately enjoys what is said. He unfolds an ample handkerchief and blows his nose noisily; he spits to a great distance and sneezes very loudly. He sleeps by day; he sleeps by night; he snores in company. At table and in walking he occupies more room than anyone else. He takes the center and walks with his equals; he stops and they stop; he walks on and they walk on; all regulate themselves by him; his opinion is accepted, the rumors he spreads are believed. If he sits down you will

see him settle into an armchair, cross his legs, frown, pull his hat over his eyes and see no one, or lift it up again and show his brow from pride and audacity. He is cheerful, a hearty laugh, impatient, presumptuous, quick to anger, irreligious, politic, mysterious about current affairs; he believes he has talents and wit. He is rich.

Mark each statement about Giton T for true or F for false.

53. ____ The dominant value in Giton's life is aesthetic.
54. ____ He is relatively insensitive to social disapproval.
55. ____ He is more interested in action than in thought.
56. ____ Giton's emotions are easily aroused.
57. ____ His chief goal is the pursuit of truth.
58. ____ Giton accomplishes little because he inhibits his actions.
59. ____ Giton lacks the common drive for social interaction.
60. ____ His self ideal includes an emphasis on power.
61. ____ He thinks of himself as the "strong silent type."
62. ____ Giton would be rated high on self-esteem.
63. ____ When he is frustrated, he withdraws.
64. ____ Giton is frequently motivated by the dependency motive.
65. ____ On a test of anxiety Giton would score low.
66. ____ He compensates for failure by daydreaming.
67. ____ He worships success.
68. ____ He is unhappy.
69. ____ In his social relations Giton is a conformist.
70. The popular concept of extroversion, the opposite of introversion, is a combination of (a) independence and lack of seriousness; (b) adaptability and lack of aggressiveness; (c) achievement and lack of emotional control; (d) sociability and lack of anxiety.
71. We know that boys and girls acquire much of their personalities from their families, and if we assume that feminine values are dominant in the typical American family, we could conclude that (a) many girls would be confused about their sex roles; (b) many boys would prefer to be girls; (c) fathers should play a larger part in socialization of children; (d) many girls would prefer to be boys.
72. A good performance test of honesty is to ask a man a question and look him straight in the eye when he answers it. True or false?
73. Look back to Judgment 3 on p. 272 in Chapter 9. If the two columns of numbers are similar, what is this effect called?
74. Measures of dependence on adults and social acceptance by peers were obtained from observation of 38 preschool children.⁴⁷ Was the relation between these two measures positive or negative?

Discussion Questions

- A. Why is there so little discussion of independent variables in this chapter?
- B. How does the popular meaning of personality differ from the technical definition used in this chapter?
- C. Do animals have personality?
- D. Could we describe personality without using traits?

- E. Is intelligence a personality trait?
- F. Could we study personality without using statistics?
- G. What do people mean by a "mature personality"?

Recommended Reading

- G. W. Allport. *Personality*. Holt, 1937. A classic survey and integration of methods, concepts, and theories used in describing individuals and studying their development.
- G. Murphy. *Personality*. Harper, 1947. A comprehensive treatment for the advanced student.
- C. S. Hall & G. Lindzey. *Theories of personality*. Wiley, 1957. A convenient introduction to the more influential contemporary theories.
- J. J. Honigmann. *Culture and personality*. Harper, 1954. A scholarly discussion based on anthropological data.
- C. S. Hall. *A primer of Freudian psychology*. Mentor, 1954. A simple paperback discussion of dynamics and development of personality according to Freud.
- P. H. Mussen & J. J. Conger. *Child development and personality*. Harper, 1956. A standard textbook on child psychology which puts considerable emphasis on the development of personality and the chief influences affecting this development at each age.
- H. C. Smith. *Personality adjustment*. McGraw-Hill, 1960. A new integration of the research on personality traits, personality structure, and the adjustment of the individual to society. Emphasis on judging people and predicting their behavior.

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HOW TO CHOOSE A PSYCHIATRIST

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ISAK DINESEN TELLS A TALE Glenway Wescott

WHITE HOUSE FEVER Robert Bendiner

THE ART OF THEATRE CRITICISM Stark Young

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Chapter 13. ABNORMAL PERSONALITIES

Abnormal psychology or psychopathology begins with complaints. Someone complains that he is unhappy or frightened. "I can't concentrate." Or his wife or neighbor complains that his behavior is peculiar. "He isn't acting right." In this chapter we attempt to describe abnormal behavior, to understand it, and to find causes and treatments.

THE NATURE OF ABNORMALITY

As long as people have been interacting with other people, some have been complaining about others. Along with the development of other social norms, legal procedures have been established for handling such complaints and a *legal concept of insanity* has been developed. Legally, a person is assumed to be normal until he has been officially classified in a different category. The official definition of insanity and the procedures for assessing it are different in different cultures and have changed somewhat in our culture over the past four centuries, but in general the judgment is made by a judge or a jury, often with the aid of expert testimony by psychiatrists. The laws of most states define the concept and list criteria to aid the judgment: "unable to understand the consequences of his acts," "dangerous to himself and others," "irresistible impulse which overcomes reason and conscience." When a person has been declared insane, he is legally in a different category from the normal, just as a married person is legally in a different category from a single person, and a person over 21 is different from a person under 21. The law does not recognize any border zone between sane and insane or any scale of degrees of normality. A judgment of insanity means that the person loses his freedom and many other rights which the normal person enjoys, such as the right to marry, to make a will, and to be a witness in court. On the other side, he is protected from punishment from crimes he may

have carried out while he was under the influence of the "irresistible impulse." Usually he is committed to a special institution where he receives care and perhaps treatment at the expense of the state or federal government.

A judgment of abnormality does not tell us much about a person. The law is not concerned with psychological investigation but with protection of society, the individual, and his heirs. The essential distinction between a sample of people committed to a psychiatric hospital and a sample of normal people is that the former sample has been subjected to a serious legal action by an official agency of society. But even though the law speaks in ancient legalistic terms, the judgments of court psychiatrists, judges, and jurors are influenced more or less, according to their education, by the other concepts of abnormality to be discussed below.

Many people voluntarily enter a psychiatric hospital or visit a psychiatrist or clinical psychologist for treatment. This too is a definite act that commits them to an expenditure of time and money and perhaps some loss of freedom. Abnormality according to this *voluntary concept* may be quite mild, but since the majority of people do not seek treatment, this act does put the person in a different category from the majority. It does not tell us much about his troubles, but it tells us that he feels his troubles are too much for him. The decision to seek professional counsel is influenced by the availability and expense of counsel, by social customs, and by the advice of friends and physicians, as well as the severity of the trouble.

Identification of abnormal personalities is difficult, and the statistics vary, depending on the method of identifying the patients. One careful study, conducted by psychiatrists and sociologists, identified mental illness as the cases under the care of a psychiatrist, a physician who specializes in mental illness. A census of those under psychiatric treatment—legally committed or voluntary, in hospitals, clinics, or private offices—in and around New Haven, Connecticut, between June and December, 1950, found 104 new cases per 100,000 of the population in this community, or 0.1 percent, during this six-month interval. Adding to the new cases the old cases continuing under treatment and the readmitted cases, the total under psychiatric care during the six-month interval was 808 per 100,000 or 0.8 percent. (The rate would probably be about 1 percent if cases treated by ordinary physicians, clinical psychologists, social workers, and others were included.) This investigation grouped the cases into five social classes on the basis of residence, occupation, and education—though Class I and Class II were later combined—and, as Table 13.1 shows, mental illness is much more prevalent in the lowest social class.¹

Symptoms do not occur singly; they occur in patterns or syndromes. For example, intellectual sluggishness, gloom, poor appetite, and suicidal

tendencies often appear together in the same patient, and these are presumed to result from one underlying cause, so the whole pattern is given a name, such as depression or melancholia. Interests, attitudes, and other traits occur in patterns also, but the patterns that are called abnormal are those

TABLE 13.1. Prevalence of Mental Illness by Social Classes

Class	Rate per 100,000
I-II	553
III	528
IV	665
V	1668
Total population	808

SOURCE: Hollingshead & Redlich, 1957.¹

that are common in people who have been identified by the legal or voluntary criteria mentioned above. *Diagnosis* consists of summarizing the patient's troubles in some systematic way and classifying him in one category or another on the basis of similarity to other patients of this category. When a psychiatrist is called into court as an expert witness, he has to use the legal concept of abnormality and he may try to talk to the judge and jury in legal terms, but his judgment of the present status of the individual and his prediction of future behavior are greatly influenced by his diagnosis of the individual.

Diagnosis may be a superficial process of attaching a label to a patient, but it may also include a psychodynamic appraisal of the patient's troubles, his adjustment to them, his liabilities and assets, and a hypothesis about causes. A diagnostic category is a theoretical construct, of course, and as research progresses the construct is changed. In any event the methods used in assessing the abnormal personality include all the methods described in the preceding chapter for assessing the normal personality, particularly interviews with the patient, study of records of past behavior assembled by relatives and social workers, and projective tests. Psychologically a diagnosis is a judgment, usually not judgment on a scale but judgment in discrete categories. Is the patient psychotic? Is he neurotic? Does he have brain damage? The symptom patterns are learned and used according to the principles of learning and the principles of judgment described in preceding chapters.² More specifically, students begin by learning to use the judgment categories used by professors and textbooks. Later they may check their diagnoses by agreement or disagreement with others, by the subsequent history of the patient, and, in the case of suspected brain damage, by

autopsy. Under the best conditions, when different psychiatrists are used to working together and making their diagnoses within a common frame of reference, independent diagnoses agree quite well—as represented by a correlation coefficient of about .90 for the major categories.³ But when psychiatrists using different frames of reference are compared, more discrepancies appear, for in some institutions 35 percent of the new admissions are diagnosed schizophrenic and in other institutions only 20 percent. In court, psychiatrists hired by the defense will naturally disagree with psychiatrists hired by the prosecution, but when an impartial board of psychiatrists is appointed by the court, the legal status of the accused is usually judged with fair agreement.

An accurate diagnosis is valuable in communicating about patients, in understanding their behavior, and in planning treatment and research because different patients in a diagnostic category do have certain psychological similarities in present status and in later history. Some diagnostic labels, moreover, such as neurosis and schizophrenia, have become part of the general vocabulary of educated people. Hence the most common diagnostic patterns will be briefly described later in this chapter.

Even though it is possible to diagnose patients with fair accuracy, when these patients are observed carefully, the difference between the normal and the abnormal does not seem clear cut. Much of the unusual behavior of the abnormal can also be observed in the normal, in a milder form at least. Conduct that is labeled abnormal might pass unnoticed in a different culture, or in a different social class, or at a different age, or in a situation that makes different psychological demands. If we look beneath the observed behavior and study the psychodynamics of these people, we find that their conflicts, anxieties, and defenses also are similar to those of normal people. These facts have provoked a variety of witticisms, mostly on the theme that the abnormal are just like the normal only more so. These facts also raise the question whether labeling people “normal” and “abnormal” is worth while. In some respects the difference is a *quantitative* or statistical one, and it is helpful for some purposes to conceive of a scale of maladjustment or mental illness instead of diagnosing people in one category or another. Some neurotics are severely handicapped by their illness, others just a little. If we count symptoms or rate their severity, the bulk of the population would be at the low end of the scale and a few would be at the high or severe end. One who is so anxious that he cannot concentrate on his work is mildly maladjusted. One who is too scared to get out of bed is worse. And one who is so confused that he does not recognize his own daughter is severely ill.

On this assumption rating scales have been devised so that judgments of patients by psychiatrists, psychologists, and ward personnel can be sys-

tematically collected and quantitatively analyzed. One scheme of this kind⁴ uses many short rating scales such as the following:

- _____ 1. No evidence that the patient considers himself to be particularly unworthy.
- _____ 2. Patient tends to blame himself or refer to his unworthiness.
- _____ 3. Patient blames and criticizes self to an unrealistic and inappropriate degree.
- _____ 4. Patient appears to have a delusional belief that he is an extraordinarily evil, unworthy, or guilty person.

Likewise, personality inventories have been devised to enable people to report their complaints, anxieties, and habitual reactions to difficulties so they can be counted and converted to numerical scores. These adjustment inventories attempt to compare people, not, as in the preceding chapter, in respect to traits common among normal people, but in respect to traits common among the maladjusted. One widely used inventory of this kind, the Minnesota Multiphasic Personality Inventory,⁵ includes a scale for measuring hypochondriasis, which is one category of neurosis. Some of the items follow. (Guess whether the hypochondriac response is T or F.)

During the past few years I have been well most of the time.

Often I feel as if there were a tight band about my head.

I sweat very easily even on cool days.

I wake up fresh and rested most mornings.

I am bothered by acid stomach several times a week.

Information from such rating scales and adjustment inventories can be conveniently collected as an aid to diagnosis or for more complete understanding of the patient. The quantitative descriptions and the diagnostic judgments agree fairly well because the rating scales and the inventories ask approximately the same questions that are asked during the diagnostic interview. The agreement is not perfect because the two methods approach the patient by somewhat different routes and because each method includes some error.

At the low or "well adjusted" end of these scales quantitative notions of abnormality have not been very useful. For those people who have no noticeable symptoms it makes little sense to say that one is better adjusted or has more mental health than another and, in fact, different measures of good adjustment, such as productivity, self satisfactions, and popularity show little agreement when obtained from a normal sample of people.⁶ There is no prominent factor of general adjustment or good personality comparable to general intelligence. We must be careful also not to confuse deviation from the social norms with deviation from psychological normality. One can be atheistic, beat, criminal, disagreeable, egotistical, intolerant,

lazy, radical, stingy, or vulgar and still be normal by any reasonable definition.

Although these four concepts of abnormality—legal, voluntary, diagnostic, and quantitative—are all related, they are not synonyms, and we shall need each of them in this chapter. Some people who are legally insane will voluntarily admit they have troubles, but some will not; and in fact some fight legally and physically to be released. Diagnostic patterns have some relation to legal actions, as we shall see, for most of the legally committed are diagnosed as psychotic while most of the voluntary cases are diagnosed as neurotic. Diagnostic patterns are related to the quantitative concept also, for psychotics are more abnormal in general than neurotics. But the psychotic's abnormalities are not only worse than the neurotic's; they deviate from normality in a different direction. Just as one can leave a city by different roads, he can depart from normality by different directions, toward different diagnostic categories.

DIAGNOSTIC CATEGORIES

Diagnostic categories, like other man-made constructs, do not fit reality perfectly, and changes will no doubt be made as research proceeds. At present there are four well-recognized major categories that provide a useful scheme for describing the most common abnormal personalities.

Psychosomatic Patterns

"Somatic" is an adjective referring to the body, so any pattern that includes both psychological and bodily symptoms can be called *psychosomatic*. All illnesses are psychosomatic in a broad sense because the bodily symptoms, such as fever, bleeding, and swelling, are usually accompanied by psychological effects, such as anxiety, egocentrism, and inactivity. Usually, however, this term is applied to syndromes in which the prominent complaints are somatic and the psychological components are less obvious. Many physicians report that in a large proportion of their medical cases the symptoms are associated with psychological problems.

The psychological part of this adjective, "psychosomatic," refers chiefly to the effects of emotional tension or arousal of activity, and we know from Chapter 2 that emotion does have serious bodily effects. We may recall that emotion affects the autonomic nervous system, releasing adrenalin into the blood stream, raising muscular tension, raising blood pressure, inhibiting digestive activity, increasing the blood supply to some parts of the body, and decreasing the blood supply to other parts. Usually these effects are transient, developing quickly in an emergency and disappearing soon after the

crisis has passed. But when the individual is incapable of recovering at the normal rate, or when the emotion situation persists, the nervous and chemical disturbances may become chronic.

Apparently it is these chronic effects of emotion that lead to the physical symptoms. If digestive activity is frequently interrupted, the digestive juices may irritate the walls of the stomach and intestines and may even cause ulcers. Prolonged high blood pressure is a strain on the heart. The chemical products of emotion, circulating through the blood stream, may raise the sensitivity of the skin and mucous membranes, increasing the possibility of allergies and asthmatic attacks. Extreme emotion has widespread bodily effects, and long-continued emotion can damage various bodily tissues. Furthermore, the body's reactions to these physiological effects or defenses against them may, if prolonged, have damaging effects of a secondary nature.

The next question is why one troubled person will develop ulcers, while another has chronic constipation, and another asthma. One possible answer is that some bodily systems are more susceptible than others to the effects of emotion, either by heredity or by the weakening effects of previous illness. The other possible answer lies in the learning process. Examples were cited in Chapter 7 to illustrate how a person may group two ideas together, like "chair" and "table," so that when he thinks of one he thinks of the other, and he responds to the one as he would to the other. If a word or a melody or a smell symbolizes danger, he may react to the symbol as to the real thing. If a person's eating habits have been built up in such a way that eating is primarily a social activity that symbolizes being cared for and protected, he may, when he feels neglected, compensate by eating huge quantities of food. And when this habit is thoroughly acquired, it is just as hard to break as any other strong habit. Some obesity, in nonglandular cases, probably comes about in this way. The child who went through emotional conflict in connection with toilet training and sees elimination as doing a favor for others may, if he becomes antagonistic to others in adult life, react by chronic constipation.

This field of psychosomatics is relatively new and is still bedeviled by the chicken-and-egg problem. When high blood pressure is associated with hostility, should one conclude that the hostility preceded the high blood pressure or the reverse? If people who smoke heavily have more lung cancer and more heart disease than nonsmokers, which is cause and which is effect? Or could both the smoking and the lung cancer be symptoms of something else?

In what respect are these people different from others? Certainly not in the legal sense. As to diagnostic patterns, these people resemble the neurotics to be described next. In a quantitative sense, we would have to say that, in comparison with normals, they have more signs of maladjustment, such as

seclusiveness, fluctuations in mood, feelings of inadequacy, and distractibility. Several attempts have been made to categorize the personalities of ulcer patients, of colitis patients, of patients with high blood pressure, and others. Unfortunately they all turn out about the same; there is no good evidence at present for an "ulcer type" or a "high blood pressure type" of personality. But this is an intriguing field of research, and such types may some day be discovered.

Neurosis

Neurosis, or psychoneurosis, is a blanket term for a variety of maladjustments that make the individual unhappy and prevent him from participating fully in life. The maladjustments are relatively minor; he can usually hold a job if he has one. Casual friends and associates may not see any personality change, but he knows something is wrong, and his relatives find him hard to live with. He may be advised to go away for a vacation, but rarely is a neurotic legally committed to a hospital.

Symptoms. Although the nature of the symptoms is not as important as the psychodynamics, the educated person is expected to know the meaning of some of these common terms. A *compulsion* is an uncontrollable drive to do something that the person knows, in his calmer moments, is not worth doing, such as stealing a pencil from a drugstore, tying and untying shoelaces, or washing windows that are clean. An *obsession* is a thought or desire that one cannot inhibit, such as the thought of being locked in a small dark room or of assaulting a stranger on the street. Obsessions and compulsions often go together; in fact, compulsions are often reactions to obsessions, as washing clean windows may quiet persistent thoughts of a dirty deed. A *phobia* is a strong irrational fear, such as fear of going up in an elevator or fear of touching a wet doorknob. *Hysteria* is more dramatic. It is an escape from an intolerable situation by adoption of symptoms like those of a physical illness, such as paralysis, blindness, and deafness. *Amnesia* or loss of memory is another incapacitating symptom that may be used to avoid difficulties. In some other cases the complaint may be just a generalized anxiety or a generalized feeling of guilt and inadequacy which prevents the individual from enjoying life in the usual way.

Statistics on neurosis are not very accurate because neurotic patients are usually treated by private practitioners and clinics, so uniform records are not easily collected. Figures from the New Haven census mentioned above indicate that the rate of cases (including psychosomatic cases) treated by psychiatrists was 196 per 100,000 or about 0.2 percent. Table 13.2 shows that the psychiatric treatment of neurosis is largely an upper-class phenomenon—because of the diagnostic and therapeutic habits of psychiatrists and the

expense of the treatment (an average of about \$2000) as well as the nature of the symptoms. In addition to this percentage, many neurotics are treated by clinical psychologists, by the family doctor, and, depending on local laws, by many others who call themselves psychologists or doctors. There are no statistics on untreated cases, of course, but some physicians claim that half the patients seen by the family doctor have neurotic complications. For the

TABLE 13.2. Prevalence of Neurosis and Psychosis by Social Classes

Class	Rate per 100,000	
	<i>Neurosis</i>	<i>Psychosis</i>
I-II	360	193
III	237	291
IV	146	518
V	163	1504
Total population	196	612

SOURCE: Hollingshead & Redlich, 1957.¹

general population round figures of 5 and 10 percent are commonly given as an estimate of the number who have had or will have a neurosis sometime during their lives. When the going is extremely rough, as on Guadalcanal in October, 1942, the percentage is higher. Here is a report of a severe case from Army medical records.

A twenty-year-old marine was admitted to the hospital approximately a week after evacuation from Guadalcanal. He appeared depressed and stunned, started sharply at any sudden sound, and could not halt his preoccupations with recent events. He ate poorly and his sleep was broken by nightmares. With considerable emotion, he told of how his gun emplacement had been struck by a bomb. He had seen the remainder of the crew killed as he was tossed through the air by the concussion. He remembered nothing that happened for several hours thereafter, but did not think that he had been unconscious as he had been told that he had "gone wild" almost immediately. In the hospital he could not control his sobbing during air raids and remained extremely jittery. He admitted that he had been finding it difficult to control himself for several weeks prior to the bomb-hit. He had choked on his food, vomited occasionally, and rarely dared to sleep. He had remained at his post hiding his apprehension from his friends. The reason for the panic reaction sounded adequate, especially when the numerous lesser traumata and the many resentments held in common with others on Guadalcanal were taken into account.

The patient improved. He kept well occupied during the day, participated in the grousing sessions on the ward, and his old buoyancy began to return. He was considered less ill than most and received little individual attention. Then he became ill with atypical pneumonia and was transferred to an isolation tent where inactivity was forced upon him. While convalescing he suddenly became rigid and cataleptic. With suggestion, he took oral sedation,

sobbed uncontrollably, and finally began to talk. The story of the bomb-hit was retold. He had been sitting in the emplacement with his lifelong "Buddy" with whom he had gone to school, college, and into the marines. His "Buddy" had yelled "Look out." In the next moment he had seen his friend blown to bits. The episode had not been forgotten, but he had avoided mention of the friend as being too painful for discussion. Subsequent discussion revealed that they had been inseparable since early childhood. The patient had regarded his friend's home as his own, and the parents even more affectionately than his own, even though his family life had been satisfactory as far as could be learned. They had patterned their lives together for many years. Now all plans had disintegrated and the patient was facing the future alone for the first time. Discussions centered about problems of mourning and the reorganization of his life without his friend. Sharing his troubles, the patient began to improve, but he remained anxious and after a week another spell of rigidity occurred.

It was learned that he had been contemplating the necessity of writing letters to his friend's widow and mother. He was unable to write and became overwhelmed at the thought of returning home and facing them. They had both taken out the same girl, but the patient had stepped aside when he realized that his "Buddy" wished to marry her, and went out with her sister instead. His older brother had married this sister shortly before the patient joined the marines. There was further improvement. The letters were written, but he remained restless and anxious. During subsequent talks an opportunity was presented to discuss his feelings toward his friend's widow. With much embarrassment and considerable guilt, he admitted to having had fleeting fantasies of marrying her. He was encouraged to express his admiration for her. Their many mutual interests and sorrows were discussed, and he learned that his feeling for her was not disgraceful. He acted as if relieved of a great burden. He was much improved when he left the hospital to recuperate in the United States. A year later a wedding invitation was received accompanied by a note telling that he was well and employed by a Federal agency that requires considerable calm and courage.⁷

Interpretation of Symptoms. The neurotic's complaints take many forms, but, following Sigmund Freud, they are generally interpreted as defenses against anxiety. Conflict between some unacceptable motive, such as hatred of one's father, and social approval may produce a feeling of anxiety lest the hatred become too strong. Feelings of guilt in connection with sex, e.g., masturbation anxiety, are relatively common in boys. In adults the conflict often involves aggressive competition against others vs. fair play and consideration for others. Obsessions are constant reminders that the evil motive may win, like a sentry constantly warning of powerful enemy movements. Since the motive may be repressed as too unacceptable even to think about, the obsession is often a warning about something else associated with or symbolic of the real motive, or perhaps even the opposite of the real motive. For example, the marine on Guadalcanal felt guilty about loving his buddy's wife but reported guilt about his buddy's death. The eagerness of some people to cen-

sor the reading matter of other people is often related to their difficulty in controlling their own desires. The obsession keeps the person tense and vigilant against dangers, but if he does not admit the basic motive, he constricts his life by avoiding imaginary or symbolic dangers.

Compulsions are motivated in much the same way. The anxiety keeps activity level high and the person produces many solutions to his problem but, since the real motive is repressed, he does not produce an adequate solution. He may, however, do something which seems to allay the anxiety temporarily, or at least to keep the real motive repressed. Any act that appears to quiet the anxiety will thus be reinforced. Phobias are defined as irrational fears, but they are not random fears. Most such fears are understandable in that the feared object represents a conflict situation in which the individual fears that he might do something he is ashamed of. The phobia, which the individual invented himself, is less fearful than the basic motive, often left over from childhood, which he does not dare admit.

Another way to handle anxiety is to anesthetize it, and the drug most frequently taken for this purpose is alcohol. When alcohol is used during periods of anxiety or in anticipation of danger, it does deaden the anxiety and this seems to reinforce the drinking. When the drinking habit is strengthened, it transfers to other situations, and this too creates anxiety, so more alcohol is needed to deaden the total anxiety. Thus this neurosis may become solidly established.

Still another way of getting out of trouble is to become incapacitated. The hysterical person seems to be saying: "Look how paralyzed I am. You can't expect me to do anything, so I am really doing the best I can." One can escape conflicts by loss of memory, loss of speech, convulsions, and leaving town and changing identity. And this kind of adjustment is superficially successful because most hysterics rid themselves of their anxieties and seem cheerful. Hysterics are "cured" by suggestion, by all kinds of drugs, by visits to shrines, and by dramatic treatment with shiny machines—for a few days. As a rule hysterics are suggestible people, usually not well educated, and they often adopt symptoms which they hear about from other patients. This is one type of neurosis, unlike the others, that is more common in the lower social classes with limited education.¹ The frequency of hysteria in the United States Army was much smaller in World War II than in World War I, presumably because of the higher level of education.

Neurotics, like other people, are all different. Nevertheless, a few general statements can be made. They are unusually sensitive to anxieties, because of heredity, early illness, or family training. There are more broken homes in the family backgrounds of neurotics than of normals.⁸ They are particularly sensitive to social disapproval or, in other words, they have strong superegos; they punish themselves. Since they are socially sensitive, they are easily

caught in the conflicts of our society: the conflict between exaltation of sex and taboos on sex, for example, or between emphasis on competition and obedience to the Golden Rule. Conflicts in the work situation, described in Chapter 9, as between continuing and quitting, are particularly difficult for the neurotic. The emotion aroused by the conflict reduces flexibility in producing solutions to the conflict, and repression of painful information also reduces flexibility. Because of their inability to face the anxiety aroused by the conflict, neurotics do not interpret their problems accurately. They lack insight or, as the saying goes, they don't think straight. But they react according to the same psychological principles as other people, and they do achieve a kind of adjustment. Their symptoms not only allay the anxiety but usually give them some additional reward, called *secondary gain*, such as attention from others, relief from some of life's unpleasant tasks, literary inspiration, or compensation by insurance. The difference is that this neurotic adjust-

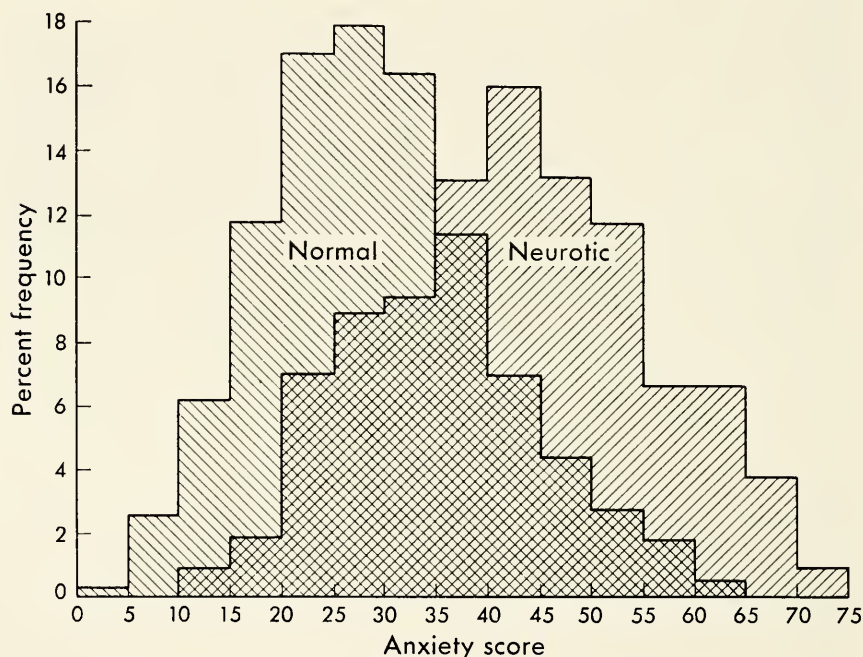


Fig. 13.1. Test scores of 759 normals and 213 neurotics on the IPAT Anxiety Scale. The mean score of the normals was 26.75, the neurotics 40.26. The cross-hatched area shows the overlap. (From Cattell⁹)

ment reduces their anxieties only temporarily and meanwhile their lives are unhappy and constricted.

In what respects are these people different from others? Certainly not in the legal sense. The chief criterion is the voluntary one. Neurotics identify themselves and seek treatment voluntarily, as a rule, and they stop treatment voluntarily also. By the quantitative criterion they are at the extreme

of a scale of adjustment because they have the same complaints and worries as the average person, but more of them. Normal people do not solve all their problems in a straightforward fashion either, but the unconscious ineffectual types of reaction are more frequent in the neurotics. See Fig. 13.1 for a comparison of neurotics and normals on one important scale: anxiety.⁹ There is, of course, no sharp line between neurotic and normal, and the proportion of people in any community who seek professional help depends on the availability of help and how fashionable neurosis is in that community, as well as the degree of maladjustment.

Psychosis

The psychoses are more serious than the neuroses. There is more of a change in personality, especially in social behavior. Psychotics often lose contact with reality, that is, they become disoriented, unable to say where they are, whom they are talking with, or what day it is. They may lose their good judgment and self-control. Thus many psychotics cannot get along in the community and have to be committed to a psychiatric hospital. About half the hospital beds in the United States are occupied by patients with some psychiatric trouble, mostly psychosis. The New Haven census found 612 treated psychotics per 100,000 population or about 0.6 percent. Other estimates that include cases cared for in other institutions and at home put the rate at 1 percent. Rates in other countries with similar hospital facilities are about the same.

The two important facts associated with psychosis are age and social class. The importance of age can be seen in Fig. 13.2, which shows first admissions to state mental hospitals—most of which are psychotics—as the rate per 100,000 of each age bracket.¹⁰ The big rise after age 60 is due to psychoses associated with aging: senile psychosis and cerebral arteriosclerosis. The association with social class appears in Table 13.2, showing the rate of treated cases per 100,000 in each social class.

Psychoses are produced by drugs, brain injuries, brain infections, hardening of the arteries of the brain, and other physical difficulties, but the most interesting, psychologically, are the two, of unknown origin, which together account for over half of the resident population of the psychiatric hospitals of the United States, namely, manic-depressive psychosis and schizophrenia.

Manic-Depressive Psychosis. Mania and depression are included in this pattern. When a manic attack begins, the patient becomes excited and elated, talks a lot, and is likely to consider himself witty. He can usually carry on a conversation but is easily distracted; in fact, one symptom goes by the colorful name “flight of ideas.” Cases of all degrees of severity have been seen. The mild ones get along quite well in ordinary life. They are rather trying to

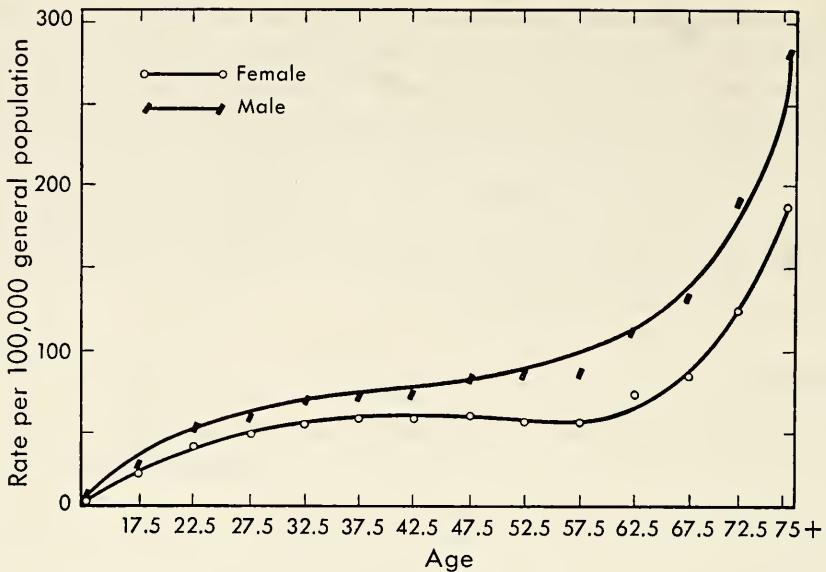


Fig. 13.2. Age and mental illness. Number of first admissions to state mental hospitals in the United States by age and sex, expressed as rates per 100,000 of the corresponding general population. (From Landis & Page¹⁰)

their husbands and wives, but some succeed in channeling their restlessness into productive work. Acute cases require hospital care because they throw restraint to the winds and follow the lead of each shifting passion. As their excitement increases, their judgment becomes poorer. They often do foolish things and get into trouble with the law just before admission to a hospital. They often lose weight because they do not have time to eat or sleep. They may become irritable and pugnacious.

A mental depression is in many ways opposite to an attack of mania. Activity and speech are blocked. Appetite is inhibited and constipation is common. The patient feels gloomy, blames himself for all kinds of sins, and may commit suicide. Since mania and depression have the similarity of opposites and since cases are known in which the patient had mania one year and depression the next, the two are often considered phases of the same psychosis, called *manic-depressive psychosis*. Patients usually recover and go home within a year.

Schizophrenia. Schizophrenia is a group of disorders that occur fairly early in life, characterized by personality changes and loss of interest in people and things, and followed often by a gradual deterioration.

L. W., a 45-year-old unmarried school teacher from a small middle-western town, was brought by relatives to a university hospital. The informants stated that the reasons for bringing her to the hospital were that she was overactive, assaultive, talked irrationally, acted peculiar, and was generally "out of her head."

The present illness seems to have begun on a Wednesday, four days before her admission to the hospital. She taught a class of "backward" children who were difficult to handle, and she had apparently assumed a very great personal responsibility in her handling of the job. She later said that she had "worked her head off trying to take care of them." Just prior to the onset of her acute illness, an incident occurred which worried her considerably. The students in this special class were each supposed to bring about ten cents to buy presents for a class Christmas party. One of the boys in the class brought \$14.00 instead, which caused her an excessive personal concern. She worried about where he could have obtained this money, took the money to the school superintendent, and wrote a letter to the boy's mother about it. When the latter did not answer her letter, she became very much upset.

During the afternoon she was busy directing preparations for the Christmas play, and began to show physical symptoms. She was tired, and complained of having a "full feeling in the head" which turned into a severe headache. When the other teachers suggested that she go home and rest up, the patient went to her boardinghouse, and then suddenly decided to go to her parents' home in a nearby town. When she arrived there, her parents recognized that she was not well and persuaded her to go to bed. The local doctor was called on the following day (Thursday), and prescribed sulfa drugs and rest in bed.

On the following evening there was a sudden and dramatic change in her condition, with the first clear appearance of grossly psychotic behavior. Her family describes her as being irrational and hyperactive. She first began to mumble somewhat unclearly about having stolen or lost \$100,000 from the school milk fund. The family went to the trouble of checking this with the school superintendent, who reported that there was no money missing. She would stand motionless for long periods merely staring vacantly into space; then would suddenly shift to a marked degree of activity. She talked vaguely about someone coming to take her away. At times she would creep around the floor on her knees with her hands outstretched, exclaiming repeatedly, "A child is born! A child is born!" (possibly a connection with the Christmas play she was directing). With considerable difficulty her parents managed to get her back into bed.

On Saturday she continued to behave peculiarly. She wandered aimlessly around the house, whined and cried a good deal, and said puzzling things. On one occasion she knelt before her mother and cried, "Mother, mother—come!" She still seemed to be under the impression that someone was coming to take her away.

When she awoke Sunday morning, she had a very difficult time putting on her stockings. She ate a hearty breakfast, and then at her parents' suggestion lay down for a nap. Upon awakening from this nap, she called her parents into the library, saying that she had something to talk to them about. However, when they had come to listen, she seemed to have some sort of blocking which kept the words from coming. After manifesting this difficulty in speech, she grasped her father's hand without saying anything and squeezed it so hard that he cried out in pain. When her mother asked her what was the matter with her, she said that her stomach hurt and that she wanted a hot water bottle for it. Upon being given the hot water bottle, the patient

began to "tear it apart." Then she suddenly became "stiff and rigid." This phenomenon alarmed the mother, who ran to the telephone saying that she was going to call the physician, whereupon the patient again became active and fought to keep her mother from the telephone. When the physician arrived and decided to administer an intravenous sedative, it required the combined efforts of four people to hold the patient down. During the half-hour or so before this injection took effect, the patient ran and rolled "all over the floor," bumping into furniture and grabbing at people so that it was necessary to keep objects clear of her to prevent her from injuring herself. Late that afternoon she was brought to the university hospital and admitted to the psychiatric ward.

As a child, L. W. was described as "very sickly," and her family had got into the habit of pampering her. As an adult, her health was fairly good. There were no previous psychotic upsets, but the patient was given to severe temper tantrums in childhood and had had several so-called "nervous spells" during her teaching career. At one school she had trouble with a school-board member whose child was in her class, and she felt that this was the reason for her being fired. At another school she "took on too much work" and was fired. School officials and other teachers have generally not liked her and seemed glad to get rid of her. Her social life was always rather meager, although when she was younger she "enjoyed going to dances." In later years her sole recreation consisted of reading and listening to the radio, and she had practically no social life.

As a child L. W. was cross and irritable, particularly around her mother. During her youth she went out a little with boys, but they did not seem to like her very much. She claims to have had two offers of marriage, but turned them down because the suitors did not meet her standards. She might seem to have maintained considerable professional and intellectual drive, as shown by her taking several "refresher" courses over the years and continuing to do a lot of reading. However, she had never really been able to enjoy her teaching and seemed mostly to have been driven by worry and the fear that she would not do the job well. She had not been very systematic in handling her financial affairs. So far as is known, she had never had any heterosexual or homosexual experience.

During the first few days after her admission to the hospital, L. W. showed more distinctly catatonic features than previously. The upper extremities were maintained in flexor contraction for many hours at a time. She was both actively and passively negativistic. If asked to perform a certain movement, she would do the opposite. When the nurse wished to take her temperature, she would close her mouth tightly. Changes in behavior sometimes occurred quite rapidly. Sometimes, within a short time, she would pass from a very violent, assaultive state to one of lying quietly and mute upon her bed, often with eyes open. Once when being neurologically examined she struck one of the physicians violently in the mouth.

Electroshock treatments were instituted on the second day in the hospital. On the second day she was given sodium amytal and responded immediately by talking lucidly before going off to sleep. Five days after admission she was still very uncooperative, although she had begun making apologetic remarks about her behavior. Gradually her condition improved and by nine

days after admission she was behaving almost normally. The delusion about stealing money had vanished, and she claimed to have no recollection of having held such a belief nor any idea of how she could have come to hold such a foolish notion. Examples of her verbal behavior during the recovering phase are: "I don't mean to be a nuisance—I wasn't brought up to be rude." "I'm sorry I was so rude to the doctor the other day. I didn't mean to hit him." Finally she became even cheerful, and in the middle of January, about one month after the onset of the acute symptoms, she was discharged to return to work, apparently quite well.¹¹

Many patterns of symptoms are included under the label of schizophrenia, such as silliness, bizarre mannerisms, hallucinations, and laughter without apparent cause. Catatonics, like L. W., present the curious phenomenon of stupor and muscular rigidity. These patients will often sit motionless for hours, shifting position only when they are not being watched. Some are impulsive, coming suddenly out of the stupor to ask who won the game or to assault an innocent bystander. In the *paranoid* form of this psychosis, the principal symptoms are suspiciousness and delusions of persecution and of grandeur, the underlying mechanisms of which seems to be projection. The paranoid patient seems to feel guilty about something, often about homosexual tendencies, and, to defend his ego, he projects this guilt onto others and suspects them of making advances toward him. A paranoid may be dangerous because, if he feels that someone is plotting against him, he may try to get the other fellow first—in self-defense. Many schizophrenics withdraw so completely from the social world that they do not attempt to make excuses for their behavior and may not communicate at all. Some paranoid patients, however, do not deteriorate like this; they welcome a chance to talk and they relate elaborate and convincing delusional systems as rationalizations for their symptoms. These are the ones who make trouble in the law courts.

"Schizo-" means "splitting," which refers to the dissociation between emotion and intellect. Most people are excited when talking about exciting things and calm when talking about calm things. But the schizophrenic may talk about some ghastly deed he did without expressing any emotion whatever, and he may become excited when the situation seems quiet to everyone else. After an initial period of excitement many schizophrenics achieve a kind of adjustment to their psychosis. Intellectual competence drops, especially ability to control attention and respond appropriately to others, as on the performance tests of social adaptability described in the preceding chapter, but many get along fairly comfortably in a hospital or perhaps at home if the family situation is not too demanding. In rough figures we may say that about a third make some kind of tolerable adjustment, a third deteriorate severely, and a third recover.

Origins of Psychoses. Since some psychoses are known to originate in physical illness, many attempts have been made to find a medical cause for manic-depressive psychosis and schizophrenia, such as infected tonsils, abnormally high or low output of some endocrine gland, or brain pathology, but no clear-cut results have yet been demonstrated. Heredity has something to do with both of these disorders; at least a person's chances of having either are greater if he has a brother or sister who has one. The chances are still small, however, and it is still true that most of the cases are children of parents who have no psychosis.

Psychoses of all kinds are much more frequent in the lower social classes, but this fact by itself tells us nothing about causes. The records show that psychotics often come from broken homes, but not as often as neurotics and apparently no more often than normals of equivalent social class.⁸ The records also show that many schizophrenics, even before they become psychotic, tended to withdraw from social contact.¹² Because of the long-term increase in the population of psychiatric hospitals, psychosis has been blamed on industrialization or urbanization, but this increase is due principally to the expansion of hospital facilities and the increased length of life. More people are now living long enough to succumb to the mental illnesses associated with old age (see Fig. 13.2). A psychosis can be understood as a massive reaction of the organism to some disturbance, and, while the common reaction patterns can be quite well described, we must admit that the nature of the original disturbance is not known.

Most people diagnosed as psychotic are abnormal according to all concepts of abnormality. Many of them are legally insane; historically the legal concept of insanity and the diagnostic concept of psychosis were developed together. The voluntary concept of abnormality applies to many psychotics because they realize they are ill, and this proportion is increasing as mental illness is becoming less humiliating—but there are some manics and paranoids who will deny that anything is wrong *with them*. Diagnostically, psychotics differ from neurotics especially in such symptoms as loss of contact with reality, social withdrawal, loss of self-control, and inappropriateness of emotion. If we think of abnormality in a quantitative way, the average psychotic is more severely ill than the average neurotic, but the categories overlap. Many neurotics and normals distort reality to some extent, especially social reality.

Psychopaths

There is another group of people, difficult to describe, that cannot be overlooked. A psychopathic personality, or psychopathic deviate, or simply a *psychopath* is not diagnosed as neurotic or psychotic, but he cannot or at

least does not conform to the demands of civilized life. Some psychopaths drink too much, some cannot hold a job, some are in frequent trouble with the law, and some even commit senseless murders. They are not necessarily unhappy, like the neurotics, and they do not usually seek psychological help. Unlike the psychotics they do not lose contact with reality. They understand the norms of society, but they ignore them.

From previous chapters we may recall that in the process of socialization most children become attached to their parents and learn socially approved behavior for positive rewards, such as parental affection. They also acquire anxiety about social disapproval and learn to inhibit actions that may be punished. The psychopath's emotions are shallow; he does not have much affection for anyone, and he is not influenced by punishment as most people are. As one might expect, he is more likely to have grown up in a broken home than others of the same social class.⁸ Thus he does not acquire a normal superego or conscience, and he does not have long-time plans or ambitions. He may steal again the day after he gets out of prison, and he may steal from someone who has befriended him. But he is not a professional criminal; he steals or murders on impulse. He does not lack knowledge of right and wrong. He is often smooth, even glib in social interaction, but he has no real concern for anyone or society in general. Neurotic people and normal people commit crimes also, but they worry about them. We may say that the neurotic's superego is too severe; the psychopath's is undeveloped.

THERAPIES

Many people recover from their psychological difficulties without special treatment, just as many recover from pneumonia. The proportion of *spontaneous recoveries*, as they are called, is high for neurosis when precipitated by severe environmental difficulties, and for manic-depressive attacks. It is low for schizophrenia. The rate of spontaneous recovery is difficult to calculate precisely because we do not have a good measure of freedom from symptoms and because a patient who leaves one therapist as recovered may go to another next month. The aim of therapy is, of course, to increase the recovery rate above the rate of spontaneous recovery.

Medical Therapy

Some behavior disorders originate in physical disease and are treated by medical procedures. Syphilis, for example, is being conquered by new drugs; and, as syphilis is reduced, psychosis associated with brain syphilis is reduced. In psychoses of unknown origin, such as manic-depressive and schizophrenic, biochemical irregularities are frequently found, e.g., in blood

chemistry under stress conditions, and if these irregularities are causes rather than results of the psychopathology, they may point the way to pharmacological therapies. At present most medical therapy is directed at the symptoms rather than the causes. Drugs and hydrotherapy make the patient more comfortable and perhaps more receptive to other therapies. Electroshock and brain surgery attempt to wall off the anxiety. As research continues, new therapies based on new theories of psychopathology will be tried, and there is always a chance that a therapy based on a wild guess may, in reverse, produce a better theory of psychopathology.

Psychotherapy and Counseling

The treatment of maladjustment by psychological methods is called *psychotherapy*. The methods, as we shall see, range from simple advice, which everyone gives everyone else, to the sophisticated techniques of the experienced therapist. When normal people go to a psychologist to discuss problems of school, marriage, employment, and the like, the procedure is usually called *counseling*. But counseling often becomes psychotherapy, and the reverse.

Environmental Therapy. If the trouble is peculiar to the present environment or someone in it, a change of environment may be helpful. Children are occasionally transferred permanently to a new home with foster parents. Students are sometimes advised to quit school. If one goes away on a long vacation or changes his job for a year, he may return with more resistance or a different attitude to the original trouble. If the trouble is within himself, he carries it with him and there is no improvement.

Psychoanalysis. *Psychoanalysis* is a theory of psychology, developed by Sigmund Freud primarily from psychotherapy of neurotics. It has led to some psychological investigations of motivation and personality development, the results of which have been discussed in previous chapters. Psychoanalysis is also a type of therapy, which usually begins with analysis of the patient's dreams and of associations with ideas in the dreams. During the conversation about these things it often appears that the patient is avoiding mention of a certain topic or event, and this *resistance*, as it is called, gives the analyst some clues to the source of the patient's anxieties. As the analysis continues, the patient builds up a close relationship to the analyst, called *transference*, and then he can talk about things he had previously repressed. Sometimes, with the analyst's encouragement, he recalls things that he had been avoiding for some time. This repressed material, often of a sexual or aggressive nature, may be connected with the original anxiety and when the old memories are revived, an emotional experience takes place, called *abreaction*. After abreaction the symptoms sometimes disappear.

Usually the events behind the maladjustment are not so obvious, and the therapist has to interpret the meaning of the associations to the patient. If all goes well, the patient gains *insight* into the origins of his troubles, learns how to handle his anxieties, and acquires more ego strength. As a rule this requires a year or more. In the New Haven community in 1950 the average cost for psychoanalytic treatment was \$6000.

Most psychoanalysts are medically trained psychiatrists; a few are trained in other fields such as clinical psychology and social work.

Client-Centered Therapy. *Client-centered therapy*, developed by Carl Rogers, depends, like psychoanalysis, on a close relationship with the therapist. But the person who enters this kind of therapeutic relationship does not lean so heavily on the therapist. Thus he is not called a patient but a client. The therapist does not tell the client what to do or what is wrong with him. Thus this therapy is often called non-directive counseling. The client tells the therapist about his troubles and the therapist encourages him to discuss how he feels about his troubles, about himself, and about other people. The therapist accepts the client, with all his queer feelings, as a person, without criticism, and the client learns to accept himself and gradually clarifies his attitudes toward himself. As he understands himself better, he becomes better able to make use of his own potentialities. It sounds easy but this type of therapy requires skillful, sympathetic listening by the therapist and serious effort by the client.

Client-centered counseling is a kind of relearning process, an important part of which is the feedback the client gets from the counselor. In the past the client learned certain attitudes toward himself, by methods described in Chapter 7, and in the therapeutic situation he practices thinking of himself in a new way. If all goes well he may actually develop a different self concept, and this change can be demonstrated by the methods described in Chapter 7 for study of the self concept.

Most of the practitioners of client-centered counseling are clinical psychologists.

There are many other special techniques of therapy. One criticism of most therapies is that they are carried out in an office between two people. *Group therapy* facilitates the learning of new attitudes toward people and new ways of dealing with people by actual practice in a group of fellow sufferers. The members of the group often find that others have problems like their own so they develop a more positive attitude toward themselves. *Play therapy*, commonly used with children, permits them to play with dolls, guns, toilet facilities, paint, and other suitable equipment to act out their problems.

All kinds of therapies, medical and psychological, are followed by improvement in some cases. The statistics on recovery agree that young people

are easier to treat than old, that people recover from recent illnesses more quickly than from illnesses of long standing, that neuroses following severe shock, as in military combat, clear up fairly well, and that best results are achieved when the patient is intelligent and anxious to cooperate with the therapist. Clear-cut statistical evaluation of psychotherapy is very hard to arrange, and the evidence at hand does not yet permit the statement that one kind of therapy produces more improvement than another or that any kind produces a recovery rate higher than the spontaneous rate.

SUMMARY

Abnormal psychology begins with complaints. Complaints of others have led to the development of the concept of insanity and legal commitment in a psychiatric hospital. Other cases are identified when they feel overwhelmed by their troubles and voluntarily seek expert help. The experts classify people in diagnostic categories to show similarities with other cases and tend to think of abnormality in a diagnostic way. One can also conceive of quantitative scales of mental illness or maladjustment. All four concepts of abnormality are in current use and should not be confused.

When medical symptoms are associated with emotional tensions, a psychosomatic relation is suspected, presumably due to chronic involvement of the autonomic nervous system. Neurosis is a minor type of behavioral maladjustment in which the individual defends his ego against anxiety by various symptoms which constrict his life and keep him unhappy. Psychosis is a more serious type of disorder, involving a larger proportion of the personality. It is much more prevalent in the older age groups and in the lower social classes. Aside from cases of known organic origin, such as cerebral arteriosclerosis, the most frequent diagnostic patterns are manic-depressive and schizophrenia. The symptoms are reactions of the organism, physiological and behavioral, to some serious disturbance, but the nature of the initial disturbance is unknown. Psychopaths are people who, through some failure of socialization, have not learned to control their behavior and get along with the rest of society.

Medical therapies attempt to alleviate symptoms or to find and treat causes. Psychotherapies of various kinds, such as psychoanalysis and client-centered therapy, try to arrange interpersonal situations in which the individual can work through his problems and learn a new pattern of adjustment.

PRACTICE PROBLEMS

1. "The fundamental idea of a contract is that it requires the assent of two minds. But a lunatic, or a person *non compos mentis*, has nothing which can be rec-

- ognized as a mind, and therefore he cannot make a contract." Who wrote this?
- A social psychologist interested in legal norms.
 - A clinical psychologist interested in comparative diagnosis.
 - A psychiatrist acting as an expert witness in court.
 - A justice of the Supreme Court.
- Some of the readers of this book will be serving on juries in the year 2000. Which concept of abnormality will they be expected to use then?
 - In respect to illness which word does not belong with the others? (a) Somatic; (b) physical; (c) psychological; (d) medical.
 - Whistling in the dark might be considered a mild (a) obsession; (b) compulsion; (c) phobia; (d) amnesia.
 - Which two of the 11 traits listed in Chapter 12 are most closely related to maladjustment?
 - When a research psychologist states that he compared a sample of schizophrenics with a sample of normals on a certain test, what does he probably mean by normal?
 - Which concept of abnormality was used in Chapter 11 in describing mental deficiency?
 - Two conclusions can be drawn from Fig. 13.1. Which two?
 - The neurotics get higher scores on the average than the normals.
 - The neurotics were not accurately diagnosed.
 - The inventory is not as reliable for the neurotics as it is for the normals.
 - Scores of the two samples overlap.
 - Normals with low scores are neurotic, but in a different way.
 - Which of these are the two most likely reasons for the overlap between the two samples of Fig. 13.1?
 - Too few questions were asked.
 - Neurotics do not answer questions as normals do.
 - Neurotics cannot really be compared with normals.
 - Errors were made in diagnosis of the neurotics.
 - Neurotics were included among the normal sample.
 - If you were to invent another term for the psychopath, which of these would be most appropriate? (a) Neurotic radical; (b) neuropsychotic; (c) sociopath; (d) dementia praecox.

Table 13.2 can be criticized in several respects. Mark + for valid, or - for invalid.

- _____ The class difference in prevalence of treated neurosis could be due to the expense of treatment.
- _____ The class difference in prevalence of treated psychosis could be due to the expense of treatment.
- _____ The class difference in prevalence of treated psychosis could be due to inaccuracies in determining the social class of the patients.
- _____ The difference in prevalence of treated neurosis and treated psychosis could be due to the expense of treatment.
- _____ Type of mental illness may be influenced by the education of the patients.
- _____ Inconsistencies between Tables 13.1 and 13.2 indicate that determining social class of the patients is subject to considerable error.

17. In one investigation of mental illness with a new personality inventory it was found that 81 percent of the neurotics and 73 percent of the psychotics reported unhappiness in their relations with their parents between ages 8 and 10. What question would you ask next?
18. A psychiatrist diagnosing a patient makes use of many kinds of information. Which of these is irrelevant to the diagnosis?
 - a. Record of patient's performance on the Rorschach test.
 - b. Patient's facial expression during conversation.
 - c. Complaints of relatives.
 - d. Number of patients recently admitted with similar complaints.
19. In making a differential diagnosis between neurosis and psychosis which of these facts would be more useful?
 - a. The patient is a married woman, age 33, with no children.
 - b. The patient appears to be very unhappy and tense.
 - c. Her blood pressure is above average for her age.
 - d. Her husband reports that she occasionally talks to herself.
 - e. She has been observed laughing when no one else sees anything funny.
20. Journalists, assuming that their readers do not know the meaning of schizophrenia, often refer to it as "split personality." What truth is there in this designation?
 - a. Schizophrenics often have two inconsistent personalities at the same time.
 - b. Schizophrenics often alternate between one personality and another during the same month.
 - c. The large nerve pathways in the brain may be interrupted by the action of pathological hormones.
 - d. Some part of the patient's knowledge is dissociated from other parts.
 - e. The patient's emotional expressions are often inconsistent with his actions.
21. What kind of symptoms are more likely to be involved in legal disputes concerning compensation claims? (a) Hysterical symptoms; (b) compulsions; (c) phobias; (d) hallucinations; (e) obsessions.
22. When you compare mental illness in one culture with mental illness in another, would you expect to find more difference in neurotic symptoms or in psychotic symptoms?
23. Nondirective therapists use the term "client" rather than "patient" for those who come to them for treatment. Why?
 - a. The client retains the right to make his own decisions.
 - b. Nondirective therapy is a very personal kind of social interaction.
 - c. "Patients" are treated only in hospitals.
 - d. Nondirective therapy is a relearning process.
24. During psychoanalysis the patient sometimes forgets his appointment. This may be considered a sign of (a) abreaction; (b) resistance; (c) transference; (d) insight.
25. In what way is the term "transference" as used in psychoanalysis similar to the "transfer" discussed in the chapter on learning?
 - a. Attitudes learned in other situations are transferred to the therapist.
 - b. Insights acquired in the solution of other problems are now applied to personal problems.
 - c. Resistance to other people is generalized to include the analyst.
 - d. Emotions learned in childhood often persist into adult life.
26. Basically, the most essential aspect of psychotherapy is (a) eliminating the

- worst symptoms; (b) reliving old emotions; (c) discovering the real causes of one's troubles; (d) learning new attitudes toward oneself.
27. Many therapists believe that anxiety is necessary for successful psychotherapy. If this is true, what is the best explanation?
- Anxiety makes the symptoms easier to diagnose.
 - Anxiety helps the client interpret his complaints.
 - Anxiety supplies the motivation to overcome the resistance.
 - Anxious people have more insight.
28. In which pair of terms is the second an example of the first? (a) Compulsion—neurosis; (b) psychosis—manic-depressive; (c) hysteria—headache; (d) murderer—psychopath.
29. Which pair of terms are synonyms? (a) Psychosomatic—psychopathic; (b) behavior disorder—psychopathology; (c) repression—forgetting; (d) resistance—competition.
30. Behavior symptoms always have (a) a physiological origin; (b) a long history; (c) a psychological interpretation; (d) a sudden onset.
31. Which of these behavior patterns in a boy of 14 would seem more serious to parents who have studied psychology than to parents who have not? (a) Telling dirty stories; (b) aggression toward parents; (c) avoidance of peers; (d) cheating in school.
32. When doctors say that someone is "nervous," are they referring to his nerves or his behavior?

The vocabulary test is used, not only as a test of intelligence, but also as an aid to diagnosis. Six of the responses below are normal, and six are diagnostic of schizophrenia.¹³ Label each Nor or Sch.

33. _____ Gamble: to take a chance, a risk
34. _____ Guillotine: part of law subject only to those without call to stay on earth
35. _____ Seclude: to go away and be alone, to seclude oneself
36. _____ Donkey: a type of four-legged animal
37. _____ Cushion: to sleep on a pillow of God's sheep
38. _____ Fable: trade good sheep to hide in the beginning
39. _____ Gown: garment you wear for lounging
40. _____ Diamond: a piece of glass made from roses
41. _____ Armory: part of army subject to call without banner
42. _____ Nail: metal I guess, let's say a metal which is made scientifically for purpose of good and bad use
43. _____ Nail: a bit of metal used to pound on
44. _____ Shrewd: careful in a sneaky, clever way

The sentence-completion test is a projective test used in psychological diagnosis. Completions by a male psychoneurotic of 19 and completions to the same items from a normal sample are printed below in groups of four.¹⁴ Mark either A or B of each group to indicate which are the four psychoneurotic endings.

45. A. *My mother has been a problem to me. My mother and I are closely tied together. I think that most mothers love their children. I like my mother but she has been a big problem to me.*
- B. *My mother is thrifty. My mother and I are good friends with different opinions. I think that most mothers allow their love to ruin their reason. I like my mother but there is no but.*

46. A. I feel that my father seldom *has shown affection toward me*. If my father would only *act like a father*. I wish my father were *more of a man*. I feel that my father is *not much of a man*.
 B. I feel that my father seldom *gets together with me as father and son*. If my father would only *listen to things*. I wish my father (no response). I feel that my father is *swell*.
47. A. When I see a man and a woman together *I wonder about how they get along*. My feeling about married life is *that it can be pleasant if both parties meet each other halfway*. If I had sex relations *I'd be more contented*. My sex life *hasn't been too interesting*.
 B. When I see a man and a woman together *I envy them*. My feeling about married life is *that it is swell*. If I had sex relations *I'm not certain how I'll react*. My sex life *has created feelings of guilt for me*.
48. A. I know it is silly but I am afraid of *being outstanding and rejected*. Most of my friends don't know that I am afraid of *being rejected and outstanding*. I wish I could lose the fear of *letting myself go*. My fears sometimes force me to *draw into my shell and even throw up*.
 B. I know it is silly but I am afraid of *some people*. Most of my friends don't know that I am afraid of (no response). I wish I could lose the fear of *talking to a group*. My fears sometimes force me to *retreat*.
49. A. I would do anything to forget the time *I had troubles as a kid*. My greatest mistake was *running away from trouble*. When I was young I felt guilty about *sex desires*. The worst thing I ever did was *joining the navy*.
 B. I would do anything to forget the time *I became hysterical*. My greatest mistake was (no response). When I was young I felt guilty about *all my sex feelings*. The worst thing I ever did was *to keep myself from advancing to my fullest capacity*.
50. Psychopaths, as a rule, have relatively little anxiety. True or false?

Discussion Questions

- A. In what way are the popular concept of hysteria and the technical concept similar? Different?
- B. If you read in the newspaper that a young attractive mother drowned her two children in the bathtub and was later judged insane but no other details are given, what is the best guess about diagnosis?
- C. Does the state in which you live spend more money on the care of psychiatric patients or on their treatment?

Recommended Reading

- A. Burton & R. E. Harris. *Clinical studies of personality*. Harper, 1955. A collection of case histories of personality disorders in adults, reactions due to brain damage, mental retardation, and personality disorders in children. Symptoms, background factors, and test results are described and interpreted.
- J. C. Coleman. *Abnormal psychology and modern life*. Scott, Foresman, 1956. A widely used college textbook.



Information Services, Michigan State University

Chapter 14. PSYCHOLOGY AS A SCIENCE AND A PROFESSION

Man has always been interested in man, but psychology as a separate science is relatively young. When the first primitive psychological laboratory was organized in Germany in 1879, philosophers, scientists, physicians, and educators were studying problems that would now be considered psychological, but hardly anyone called himself a psychologist. At first psychology borrowed heavily from other fields, such as sensory physiology and philosophy, but gradually the young science accumulated methods and a body of knowledge of its own. Universities began to teach the subject, at first only in post-graduate schools and often under unusual names, such as mental philosophy, and thus a few students began to get an introduction to facts and principles organized around human activities.

The pioneers of this science in the United States, many of whom had studied in Germany or England, were drawn together by common interests and problems—like historians and mathematicians—and in 1892 they organized their own scholarly organization. The growth has been extraordinary, from 31 in 1892 to 18,215 in 1960, partly because of the exciting contributions of intelligence tests to World War I and of clinical psychology to World War II, and partly because of the steady maturation of psychological science in general.

In the early years practically all psychologists were college professors, doing a little research in their spare time. In recent years, however, as the value of psychological techniques has been proved, society has made great demands for psychological services, so most psychologists today are working in hospitals, schools, military organizations, business, and industry, and only about a third are college teachers. Thus psychology is not only a science but now also a profession, like geology and accounting, with the usual professional and interprofessional problems. Like the other occupational groups mentioned in Chapter 10, psychologists have developed group customs, such

as annual meetings, publications, some control over the members, a Washington headquarters, a public relations expert, and group insurance.

Research, both pure science and applied science, has expanded at a correspondingly rapid rate, so in the United States many millions of dollars are spent each year for this purpose. For example, in 1959 the federal government alone allotted 31 million dollars to psychologists for research, mainly through the Department of Defense, the Department of Health, Education, and Welfare, and the National Science Foundation.¹ A necessary consequence of all this development is that many psychologists have had to become administrators, spending their time directing research staffs, educational organizations, psychological clinics, and the like.

Psychological Specialities

Like the other sciences psychology has become specialized. One classification, arranged for the Scientific Register of the National Science Foundation in 1954, is given in Table 14.1 with the percentage of psychologists in each

TABLE 14.1. Psychological Specialities and the Percentage of Psychologists in Each

	Percent
Clinical	37
Counseling	11
Developmental	3
Educational	4
School	4
Experimental	13
Human engineering	2
General	3
Industrial	5
Personnel	6
Personality	5
Social	6
Quantitative	3

SOURCE: Sanford.²

category at that time.² Each speciality includes psychologists engaged in teaching and research as well as those giving psychological services. Most psychology departments offer advanced courses in some of these specialities, though the names may not be exactly the same as in Table 14.1.

Clinical psychology is that speciality that diagnoses and treats behavior problems, as described in Chapter 13. Clinical psychologists work mostly in hospitals and clinics, but some are in industry and a few are in private practice. *Counseling psychology* is that speciality that helps people in their ad-

justment to school, employment, marriage, religion, and other common problems. Psychologists in this field work in counseling and guidance centers in high schools and colleges and also in prisons, special training schools, and hospitals with individuals preparing to readjust to outside community life. Clinical and counseling psychology have much in common but as a rule clinical psychologists make more use of projective tests and deal with the more serious behavior problems while counseling psychologists make more use of tests of abilities, personality, and vocational interests and deal with the more common problems of normal people.

Developmental psychology is concerned with the development of the individual throughout the life span. Some psychologists call themselves child psychologists; some are particularly interested in adolescence; and some have recently specialized in the psychological problems of older people. Much of our knowledge of the development of abilities in Chapter 11 and of socialization in Chapter 10 has come from the research of child psychologists. *Educational psychologists*, many of whom are in colleges of education, are interested in the adjustment of the individual to the school situation, which includes an emphasis on learning in the classroom and evaluation of abilities and achievements. *School psychologists* work in the schools, giving expert counsel on special programs, administering psychological tests, and working directly with children referred by teachers.

Experimental psychology is as much a method as a body of knowledge, concerned with the scientific investigation of behavior under controlled conditions, usually in the psychology laboratory. Most of the facts and principles of Chapters 2 to 8 come from this source. The majority of experimental psychologists are in colleges and universities, and most of them are active in research. *Physiological psychology*, which applies physiological methods and principles to the understanding of behavior, and *comparative psychology*, which compares the various animal species in respect to behavior, are often included under experimental psychology, as they are in Table 14.1. *Human engineering*, also called applied experimental psychology, applies psychological principles and methods to the design of machines, instruments, vehicles, and even to training programs in which men and machines have to work together.

Industrial psychology is the speciality that applies psychological principles to people at work: methods of work, job satisfaction, motivation for work, and the like. *Personnel psychology* often has the same meaning but includes more emphasis on the selection and training of employees, training of foremen and supervisors, development of executives, and the like.

The *psychology of personality* is concerned in a specialized way with the topics covered briefly in Chapter 12. Specialists in this area are interested particularly in the normal personality, while clinical and counseling psy-

chologists are more interested in people with problems. *Social psychology* is the special study of topics covered briefly in Chapter 10. Research in social psychology is conducted by psychologists and by sociologists, and courses in this subject may be taught in either department, usually with different emphases. Some social psychologists are experts in opinion polls and market analysis.

All psychologists have some training in psychological statistics, but *quantitative psychology* is a speciality that develops mathematical theories, mathematical methods for handling psychological data, and statistical techniques for constructing tests, as described in Chapter 11. *Psychometrics* is a special term for psychological measurement, as in the measurement of brightness, loudness, and abilities.

Psychological Occupations

Another way of looking at modern psychology is to ask where psychological activities are carried on and who pays for them. This is not an easy question to answer because psychological techniques are used by many people of various specialities in many places. But psychologists love facts and figures, even about themselves, so a survey was undertaken in 1955 to get at least a partial answer to this question.³ The survey looked up all the people who were using psychological techniques in three areas: Milwaukee County, Wisconsin, where 213 such people were found; Providence, Rhode Island, 77; Atlanta, Georgia, 105. About two-thirds of these were men, and one-third women. Table 14.2 shows the percentages employed in various places.

TABLE 14.2. Employment of Persons Engaged in Psychological Activities in Three Communities

	Milwaukee	Providence	Atlanta
Universities and colleges	23%	38%	38%
Schools	21	21	7
Industry	19	1	4
Civil service	11	17	22
Social agencies	8	4	2
Veterans Administration	8	8	14
Hospitals	3	6	0
Private practice	7	5	13

SOURCE: Clark.³

Those employed in universities and colleges are mostly in teaching and research positions; a few are in counseling centers and administrative positions. As a rule, psychologists in the smaller colleges spend most of their time teaching. In the large universities a larger proportion of the time goes to research, often financed by grants from philanthropic foundations, from gov-

ernmental organizations, from military organizations, and from business and industries with a specific psychological problem to be investigated. As in the other sciences the basic research usually comes from the universities.

Psychologists in civil service perform many specialized functions. Some are personnel psychologists working with other civil service employees, testing, training, and doing research. Others are involved in special programs, such as vocational rehabilitation and training of the mentally deficient. Psychologists in social agencies, in the Veterans Administration, and in hospitals are mostly clinical psychologists working with children or adults. Most are offering a wide range of psychological services, but a few are engaged in research and a fair percentage in administration.

The private practice of psychology includes clinical psychology, counseling psychology, and vocational guidance for individual clients as well as consultation and research on personnel and industrial problems for large corporations. Some private consulting firms specialize in advertising research, some in the selection of executives, and some in human engineering.

As Table 14.2 shows, these three communities are not alike in their utilization of psychology, and other communities are no doubt different from these. But the table does display the range of employment opportunities and something of how psychology has become embedded in modern society.

Education and Training

Of the 395 people in Table 14.2 about 28 percent had no more than a bachelor's degree, 43 percent a master's degree, and 23 percent a doctoral degree. Naturally those with the higher degrees of education hold positions of greater responsibility and income.

An undergraduate major in psychology in most colleges requires a laboratory course in experimental psychology, an introduction to psychological statistics or psychometrics, and some distribution of courses in special areas like the ones in Table 14.1. Those who plan to continue in psychology are usually encouraged to get a good background in mathematics, physics, physiology, sociology, anthropology, and philosophy, especially the philosophy of science. Language study is desirable because a reading knowledge of one or two foreign languages is required for advanced work and because psychologists travel often to foreign countries.

Postgraduate education includes advanced study of psychological concepts and theories, psychological statistics, and research methods, as well as special training in one or more of the specialties of Table 14.1. Clinical psychologists study projective tests and psychotherapy, for example. Personnel psychologists get special practice in giving employment tests, interviewing, and conducting morale studies. Experimental psychologists learn how to build

psychological apparatus, handle laboratory animals, design experiments, and construct theories. All of them make a start on research. The records show that graduate students in psychology have high intelligence and high interest in intellectual activities—like graduate students in most other areas. The distinguishing characteristic of psychology students according to recent research is an interest in the application of scientific methods to human behavior. A master's degree requires one or two years of postgraduate study, a doctoral degree at least three years. Clinical training requires an internship of a year. Many scholarships, research assistantships, and other forms of financial assistance are available for superior students.

PRACTICE PROBLEMS

1. If, after studying this book, you were to propose a new name for psychology, which would be most appropriate? (a) Human biology; (b) behavior science; (c) psychophysics; (d) human engineering; (e) mental measurement.
2. After studying this book, which of the statements below do you feel is a misconception of psychology?
 - a. Psychology is a biological science.
 - b. Psychology is a social science.
 - c. Psychology teaches people to conform.
 - d. Psychology attempts to measure human traits.
 - e. Psychology tries to make people interested in other people.
3. If a psychologist spends two years investigating the correlation between metabolism and attitude toward economic change, in which speciality of Table 14.1 would he be classified?
4. In what type of employment (Table 14.2) would you expect to find him?
5. Medicine depends on bacteriology in the same way as clinical psychology depends on (a) human engineering; (b) psychology of personality; (c) personnel psychology; (d) educational psychology.
6. Engineering depends on physics in the same way as industrial psychology depends on (a) social psychology; (b) developmental psychology; (c) counseling psychology; (d) abnormal psychology.
7. From the material in this chapter one could predict that psychologists would have cooperative and competitive relations with (a) historians; (b) zoologists; (c) sociologists; (d) physicists.
8. From the material in this chapter one could predict that psychologists would have cooperative and competitive professional relations with (a) psychiatrists; (b) pediatricians; (c) optometrists; (d) accountants.

Discussion Questions

- A. What do people mean when they say, "There must be something psychological about that?" What should they mean?
- B. Is psychology a biological science, or a social science, or something else?
- C. Describe the stereotype of a psychologist and note which aspects of it are correct and which are not.

Recommended Reading

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Glossary

Only the technical, psychological uses of terms that appear in this book are listed here. Meanings that can be found in a general dictionary are not included.

In the interests of standardization two dictionaries have been consulted and followed to the extent feasible in an introductory text: Drever, *A dictionary of psychology* (Penguin, 1952), and English & English, *A comprehensive dictionary of psychological and psychoanalytical terms* (Longmans, Green, 1958).

ability. Quality of an individual necessary to overcome difficulties. Thus an *ability test* is a standard series of tasks or items, response to which can be scored as success or failure, given under optimal conditions.

abnormal. A general term, referring to behavior that deviates, by one criterion or another, from typical behavior. The most common criteria are legal, voluntary, diagnostic, and quantitative. *Abnormal psychology* is a division of psychology that studies such deviations.

abreaction. The process, during psychoanalysis, of reliving a repressed experience, during which the associated tension may be released. Also called **catharsis**.

acceleration. Change in the rate at which new items are acquired during continuous learning. An increase in the rate, e.g., from two per trial to three per trial, is called *positive acceleration*; a decrease in the rate is called *negative acceleration*.

acceptance. A quality of interpersonal behavior by one person that permits another to be himself, with the usual quota of human frailties, without threat. Contrast with **rejection**.

accommodation. Adjustment of the curvature of the lens, thus bringing light rays from the object of regard to a focus on the retina.

achievement. Success in bringing an effort to the desired end. *Achievement motivation* is motivation for success. An *achievement test* is one used to indicate present knowledge and skill. See **aptitude test**.

adjustment. Generally harmonious relations with the environment.

adrenaline. Hormone secreted by the central portion of the adrenal glands, located near the kidneys.

age norms. A table of equivalents for converting the performance on a test to a corresponding age score.

- age score.** Number used to express performance on a psychological test in reference to the performance of representative children. E.g., an age score of 8 represents performance equivalent to that of the average child of eight.
- amnesia.** Pathological loss of memory.
- anxiety.** A persistent emotional state characterized by vague dread and anticipation of danger; a drive to avoid the anticipated threat.
- applied psychology.** A general term for those divisions of psychology, e.g., industrial, which emphasize the application of psychological principles to practical problems.
- approach-approach conflict.** A conflict characterized by attraction to two incompatible goals at once.
- approach-avoidance conflict.** A conflict characterized by attraction to and avoidance of an object or situation.
- aptitude test.** A test used to predict future performance. See **achievement test**.
- assimilation.** Conceptualizing an unfamiliar object by its similarity to a familiar class of objects.
- attention.** Selection of some stimuli, rather than others, to respond to; preparation for perception.
- attitude.** Tendency to react in a consistent way, favorable or unfavorable, to a class of objects.
- audiogram.** Chart showing hearing loss at several frequencies.
- audiometer.** Instrument for testing hearing. Sounds of several frequencies are generated at various decibel levels above the normal threshold so the hearing loss is determined in decibel units at each frequency.
- autonomic nervous system.** A system of nerves and nerve centers outside the spinal cord which innervates smooth muscles and glands.
- average.** Central tendency of a distribution of scores. See **mean** and **median**.
- avoidance-avoidance conflict.** A conflict between two avoidance motives in a linear situation such that avoidance of one object means approach to the other.
- blind spot.** An area of the retina, where the optic nerve leaves the eyeball, that is practically insensitive to light.
- brain waves.** Popular term for electroencephalogram.
- brainstorming.** Popular term for the attempt to improve the production of ideas in a social group by postponing criticism of these ideas.
- brightness.** Prominent intensive attribute of perceived light sources and reflecting surfaces, described by such terms as "dim" and "brilliant," and related to the intensity and wavelength of the physical stimulus and the adaptation of the eye.
- caste.** A class of people rigidly separated from others, as by a taboo against intermarriage and restriction to certain occupations.
- catatonic.** Pertaining to a type of motor disturbance, common in schizophrenia—either extreme immobility or extreme excitement.
- catharsis.** See **abreaction**.
- central nervous system.** Brain and spinal cord.
- cerebellum.** A division of the brain, above the back of the neck, involved in balance and coordination of movements.
- cerebral cortex.** Outside layers of the brain, just inside the skull.
- character sketch.** Literary form of personality description.

- check list.** List of adjectives descriptive of personality. Those that apply to an individual are to be checked, the others skipped.
- classical conditioning.** Conditioned-response learning as originally described by Pavlov. A stimulus that elicits a certain response is preceded by a neutral stimulus, and after several such associations, the previously neutral stimulus elicits the response.
- classification.** Putting things together in classes or categories on the basis of some common property or properties.
- client-centered therapy.** Psychotherapy in which the client retains responsibility for his own decisions while the therapist helps him explore his attitudes toward himself and others. Also called **non-directive therapy**.
- clinical psychology.** Division of psychology concerned with research and treatment of psychological maladjustment.
- closure.** The tendency, when perceiving an incomplete pattern, to close the gap and thus complete the pattern.
- cochlea.** Spiral conical structure in the inner ear, which contains the auditory receptors.
- cognition.** The process of acquiring knowledge about objects and events; the knowledge thus acquired.
- cognitive organization.** Fitting related facts together in a pattern, thus achieving understanding or insight.
- color.** Prominent qualitative attribute of perceived light sources and reflecting surfaces, described by such terms as "red" and "blue," and closely related to the wavelength of the physical stimulus.
- comparative psychology.** Division of psychology concerned with systematic comparison and contrast of the behavior of all animal species.
- compensation.** Action taken to overcome a feeling of inadequacy. If the action takes an extreme form, it is called *overcompensation*.
- complementary colors.** Colors that make gray when mixed in the proper proportions, e.g., yellow and blue.
- compulsion.** Action performed by an individual which is in some way inconsistent with his personality but which he is unable to control.
- concept.** A class of objects that have some properties in common, e.g., grapes, or a common property of several objects, e.g., sweetness.
- conceptual system.** An interrelated arrangement of concepts, usually of two or more levels of abstraction, intended to refer consistently to a definite division of knowledge, as in classifying plants or religions.
- conditioned response.** Response evoked, as a consequence of conditioning, by a stimulus which did not previously evoke it.
- conditioned stimulus.** Stimulus that elicits, as a consequence of conditioning, a response that it did not previously elicit.
- conditioning.** The process or processes by which conditioned responses are learned. See **classical conditioning** and **operant conditioning**.
- cone.** Conical nerve cell in retina, sensitive to light and believed to respond differently to different wavelengths and thus to form the basis of color vision.
- conflict.** Simultaneous arousal of antagonistic motives. See **approach** and **avoidance**.
- conformity.** Acting in accordance with social norms.

- consciousness.** Awareness; subjective experience; feelings, thoughts, sensations that only the experiencing individual can observe.
- construct.** A concept formally proposed and defined as part of a theory.
- context.** Surrounding words, as in a sentence, that influence the meaning of a particular word.
- contrast.** Shift in perception or cognition of any object due to adjacent objects.
- control conditions.** Ordinary conditions, not influenced by the independent variable. Behavior influenced by the independent variable is compared to behavior under control conditions.
- control group.** A group of subjects of an experiment not exposed to the independent variable. Behavior of the experimental group is compared to the behavior of this group.
- convergence.** Turning the eyes inward to look at a near object.
- correlation coefficient.** Number expressing the relation between two variables, as when each individual in a sample has been tested on two tests. A high correlation, .80 to 1.00, means that if a person's score on one test is large relative to the mean, the probability is high that the other is large relative to the mean. If the correlation is low, .20 or less, the score on one test yields very little information about the score on the other.
- counseling.** Expert guidance in making decisions.
- counseling psychology.** Division of psychology that helps people solve their problems, especially educational and vocational problems.
- creative thought.** Production of original solutions to problems, inventive thought, creative imagination.
- criterion.** A measure of job success, e.g., volume of sales, against which a test used for selection of employees is validated. See **validity**.
- cross-section method.** Studying development by comparing groups of different ages at one time. Contrast with **longitudinal method**.
- cue.** Any feature of the stimulus situation, often one to which attention is not explicitly directed, that influences perception or action.
- culture.** The pattern of learned achievements, such as values, norms, concepts, and skills, which characterizes the behavior of most people in a given area and which is passed on to the next generation.
- decibel.** Logarithmic unit for expressing the intensity of a sound or light relative to standard threshold intensity. A decibel is 10 times the \log_{10} of the ratio of the two intensities.
- decision.** Selection of one of several alternative plans of action.
- defense mechanism.** Reaction pattern originating as a protection against anxiety or loss of self-respect. Also called an **ego defense**.
- demagogue.** One who attempts to arouse discontent and use it to increase his power as a leader.
- dementia praecox.** An old term for schizophrenia.
- dependency.** Tendency to seek help from others and to avoid situations which call for initiative.
- dependent variable.** The aspect of behavior under experimental investigation. Variations in the dependent variable are compared with variables under the experimenter's control, called independent variables.
- development.** Continuous change in an organism from origin to death. For the

- two major principles intended to explain psychological development, see **matur-
uration** and **learning**.
- developmental psychology.** Division of psychology that studies changes in the individual throughout the life span. The major subdivision is child psychology.
- deviation.** The difference between any score and the mean of the distribution of scores.
- diagnosis.** Expert judgment intended to assign a patient to a category of pathology that contains other patients of similar symptoms.
- differential abilities.** Abilities that are more specific than general intelligence and relatively independent of each other. Examples: verbal ability, numerical ability.
- differential psychology.** A major division of psychology, centered on the study of differences between people, the development of such differences, relationships among them, and methods of investigation. Also called the *psychology of individual differences*.
- discrimination method.** Any method which requires the subject to detect a difference between objects or stimulus magnitudes.
- displacement.** Change in the object toward which behavior is directed, especially a change in the object of aggression from the person or condition that produced the frustration that produced the aggression to someone else.
- distraction.** Shifting of attention away from the stimulus that one was set for; a stimulus or condition that causes such a shift of attention.
- distribution.** A systematic grouping of statistical data into classes according to frequency of occurrence, usually represented by a table or graph. The most common state of affairs is a *normal distribution*, in which the variations of the data are due to many independent factors, represented by a symmetrical, bell-shaped frequency curve.
- drive.** Internal condition that initiates and guides behavior toward a goal, especially when related to physiological processes.
- educational psychology.** Division of psychology concerned with general problems of education.
- ego.** A general term for conscious, intellectual activities mediating between the biological drives and the realities of the world.
- ego defense.** Reaction pattern originating as a protection against anxiety or loss of self-respect. Also called a **defense mechanism**.
- ego involvement.** Thorough acceptance of a task, so that completion becomes essential to self-respect.
- electroencephalogram.** Record of changes in electric potential observed when electrodes are fixed to the skull.
- embedding.** The loss of identity of a pattern when its features are absorbed into a larger pattern.
- emotion.** A complex organismic reaction, usually brief, of varying degrees of intensity, which includes conscious feelings, physiological changes, and overt behavior.
- emotional.** Pertaining to emotion or motivation.
- ergograph.** Instrument for continuous recording of work done.
- ethnic.** A noncommittal term pertaining to any continuing group or division of mankind, racial, national, religious, or what not.
- expectancy table.** A table of statistical data showing frequency of occurrence of

- job success or other events in relation to test scores or other predictors and leading to expectations of future job success in relation to future test scores.
- experience.** To be aware of, adjust to, or live through an event; past adjustments to events, or practice.
- experiment.** A definite arrangement of the conditions under which an event occurs and is observed in order that the influence of these conditions can be determined.
- experimental conditions.** Conditions which include an independent variable.
- experimental group.** A group of subjects influenced by the independent variable.
- experimental psychology.** Division of psychology concerned with psychological research under controlled conditions, and principles and theories derived therefrom.
- extinction.** Weakening a response to a stimulus, as by eliciting it repeatedly without reinforcement.
- eye-voice span.** The amount by which the eye leads the voice in oral reading, measured by the number of letters or words between the word being spoken and the word being looked at.
- fantasy.** Idle daydreaming or reverie, often, as a reaction to frustration, in the form of imaginary goal activities.
- feedback.** Perception of the result of one's acts.
- figure-ground relation.** A general property of a perceived field of being divided into at least two parts, one, small and central, called the figure, the other, extensive and homogeneous, called the ground or background.
- fixation.** Holding fast, as when the eyes, during reading, stop moving and center on a word.
- flexibility.** Readiness for change in behavior to meet changing circumstances.
- fluency.** Rate of production of responses to specifications, especially verbal responses. If the specifications are linguistically meaningful, it is called *ideational fluency*.
- fovea.** Small area in the center of the retina, closely packed with cones, where vision is most acute and where light from an object falls when one looks directly at it.
- frame of reference.** The perceptual or cognitive background, often not explicitly identified as such, within which an object is evaluated.
- frequency.** (1) Number of cycles per second in a periodic vibration, such as a sound wave. (2) Number of occurrences of a specified event, such as births, or IQ's between 90 and 100.
- frustration.** Blocking of goal-directed activity; the emotion arising from such interference.
- functional fixedness.** Temporary loss of availability of a function of an object as a solution to a problem because of its use in another context for a different purpose.
- galvanic skin response.** Increase in the electrical conductance of the skin during emotion and strain.
- genetics.** Science of heredity.
- goal.** Object or condition toward which activity is directed.
- goal response.** Pattern of responses by motivated organism when goal is reached.
- group process.** Identifiable type of social interaction between members of a social group.

- group structure.** Stable aspects of a group, such as cliques, communication channels, and status differentials, that influence group activities.
- group test.** A test that can be administered to many people at once, in contrast to individual test.
- halo effect.** The tendency, when rating a person on several traits, to be influenced by a general impression of the person so that the various trait ratings are similar.
- higher unit.** Complicated performance organized by combination of simpler performances but executed smoothly as a continuous whole.
- homeostasis.** Maintenance of internal physiochemical equilibrium, despite environmental changes, by a variety of automatic mechanisms.
- human engineering.** An applied science, participated in jointly by psychologists and engineers, concerned with the design of equipment and the arranging of the physical conditions of work.
- hyperthyroid.** Pertaining to a condition of excess thyroid secretion.
- hypothesis.** A tentative explanation, adopted temporarily in order to plan research to test its consequences.
- hypothyroid.** Pertaining to a condition of insufficient thyroid secretion.
- hysteria.** Psychological disorder characterized by dramatic physical symptoms, such as blindness, associated with severe conflict.
- identification.** A general principle of personality development, namely, patterning oneself after an admired person or group.
- idiot.** Severe intellectual deficiency, indicated by IQ below 20.
- illusion.** Perception inconsistent with another that is accepted as correct.
- imbecile.** Moderate degree of intellectual deficiency, indicated by IQ in the range 20 to 50.
- incentive.** Object or symbol used as a goal to motivate behavior.
- incidental learning.** Learning that takes place without explicit motivation.
- incubation.** Development of a solution to a problem, after a start has been made, during periods when attention is directed elsewhere.
- independent variable.** Variable manipulated in an experiment in order to show how it affects a dependent variable.
- individual difference.** Any characteristic by which one individual may be distinguished from another. The investigation of individual differences is a special division of psychology, also called **differential psychology**.
- individual test.** A test that can be administered to only one subject at a time, in contrast to group test.
- industrial psychology.** Division of psychology concerned with application of psychological methods and principles to industrial problems.
- in-group.** Those who are accepted by and identified with a group, as contrasted with outsiders or members of an out-group.
- inhibition.** Restraint of some activity by another activity. Also see **interference**.
- insanity.** A legal concept, referring usually to a loss of responsibility for one's behavior.
- insight.** Understanding of relations, either cognitive relations, as in solving a problem, or personal relations, as in estimating one's own assets and liabilities.
- instinct.** Inherited drive.
- instrumental activity.** Activity which is preparatory to goal activity.
- instrumental conditioning.** See **operant conditioning**.

- intellectual deficiency.** Subnormal intellectual development, indicated by IQ below 70 or so. See **moron**, **imbecile**, **idiot**.
- intelligence.** Intellectual ability, or ability to solve problems. The common factor required for success on a variety of psychological tests is often called intelligence or *general intelligence*.
- intelligence quotient, IQ.** An individual's performance on a test of general intelligence expressed in relation to the performance of a representative sample of the same age. The classical IQ, used up to age 16, does this by dividing MA by age, and the *deviation IQ* uses separate norms for different age groups.
- interests.** Attraction toward something, manifested by a preference for attending to it or participating in it.
- interference.** Impairment of retention of some items by the learning of others. Also called **inhibition**. When the learning inhibits retention of previously learned material, it is called *retroactive interference*; when it inhibits later learning, it is called *proactive interference*.
- intermittent reinforcement.** Reinforcing a response less than 100 percent of the time.
- interpersonal.** Pertaining to relations between individuals, social.
- interposition.** Concealment of part, but not all, of one object by another in front of it; a cue for perception of distance. Also called **overlapping**.
- interview.** Conversational situation, designed for collection of information and observation of behavior.
- iris.** Pigmented muscular disk surrounding the pupil of the eye.
- item.** Any part of a series of things. Thus the questions or problems on a psychological test are called items, and *item analysis* is the statistical study of their difficulty, their relation to the test as a whole, and their usefulness.
- job analysis.** Study of the tasks involved in a job, the requirements, opportunities, and hazards.
- job satisfaction.** General feeling of reward arising from employment.
- judgment.** Solution of a problem by assigning an object to one of several alternative categories. In *comparative judgment* one of two objects is assigned a comparative adjective, such as "longer" or "more useful." Also see **rating**, **ranking**, and **decision**.
- kinesthesia.** Sense of position and movement of movable parts of the body.
- knowledge of results.** Information during learning about correct responses and amount and direction of errors.
- law of effect.** A principle of learning developed by E. L. Thorndike: Responses that are followed by satisfying effects are strengthened, and those followed by annoying effects are weakened.
- leaderless-group technique.** Placing candidates for leadership in a group with a task to perform but no designated leader and observing who assumes the leadership role.
- leadership.** A special social role characterized by power to direct group activities and by responsibility for group effectiveness.
- learning.** The process of acquiring new behavior patterns as a result of motivated practice; the behavior patterns, e.g., knowledge and skill, thus acquired; the broad psychological topic which includes forgetting and remembering, as well as acquisition, of new behavior patterns.
- level of aspiration.** Standard by which a person judges his performance as a success or a failure.

- longitudinal method.** Studying development by following one or more individuals over a long time interval, observing and testing them repeatedly. Contrast with **cross-section method**.
- loudness.** Prominent intensive dimension of heard sounds, described by such terms as "soft" and "loud," and related primarily to the intensity of the physical stimulus and secondarily to frequency.
- magnitude estimation.** Measurement of a psychological variable by having the observer estimate one psychological magnitude, e.g., the loudness of a sound, in relation to another.
- maladjustment.** Persistent failure to solve routine problems posed by the environment.
- manic-depressive psychosis.** Behavior disorder characterized by extreme deviations of activity and mood, such as hyperactivity and elation (the manic phase) and hypoactivity and gloom (the depressed phase).
- maturation.** Hereditary aspect of development.
- mean.** An average or central tendency of a distribution of scores. The sum of the scores is divided by the number of scores.
- median.** An average or central tendency of a distribution of scores. The scores are ranked in magnitude from low to high, and the median is the point that separates the bottom half from the top half.
- mental.** Pertaining to the mind or intellect in contrast to the body.
- mental age, MA.** Performance on a test of general intelligence expressed as an age score; hence an MA of 9 represents intellectual performance equivalent to that of the average child of nine.
- mental deficiency.** See **intellectual deficiency**.
- mnemonic.** Scheme for aiding recall.
- moron.** Mild degree of intellectual deficiency, indicated by IQ in the range 50 to 70.
- motivation.** A general term for the initiation and control of behavior.
- motive.** Internal condition that initiates and guides behavior toward a goal, especially a social goal.
- motor.** Pertaining to muscular movement, as in motor learning.
- motor nerve.** A nerve that terminates in a muscle or gland.
- muscular tension.** State of partial contraction of a muscle, measured by mechanical or electrical apparatus when the muscle is stationary.
- near point.** The nearest point to the eye at which an object can be seen or print can be read clearly.
- negative adaptation.** Learning not to respond to certain stimuli.
- negativism.** Tendency to resist suggestions from other people.
- neurosis.** Mild mental illness, characterized by a variety of behavior symptoms, such as anxiety, phobias, compulsions, and obsessions.
- non-directive therapy.** See **client-centered therapy**.
- objective.** Existing in the world, not subjective; therefore open to public observation.
- obsession.** Recurring unwelcome ideas or thoughts, usually about threatening events.
- operant conditioning.** Increasing the rate of production of certain acts, e.g., lever pressing, smiling, by giving reinforcement when and only when the operant occurs. Also called **instrumental conditioning** and **instrumental learning**.
- organic.** Pertaining to the body or organism; somatic.

- organism.** Living being. This term emphasizes the coordination between physiological systems and between these and behavior.
- organismic variable.** Internal condition that influences behavior.
- originality.** The difference between the products of anyone's creative efforts and the products usually turned out under similar conditions.
- out-group.** Those who are excluded from a particular group, called the in-group.
- overlapping.** (1) Concealment of part, but not all, of one object by another in front of it; a cue for perception of distance. Also called **interposition**. (2) The extent to which the distribution of scores of one group extends into the distribution of scores of another group.
- overlearning.** Continuation of practice after improvement is no longer obvious.
- overt.** Open to view, observable.
- overtone.** Additional tones produced by a string or other vibrating body when it vibrates in parts.
- paranoid.** Pertaining to delusions of grandeur or persecution.
- peer group.** Group of people of about the same age and status, especially children and adolescents.
- percentile norms.** A table of equivalents for converting the performance on a test to a corresponding percentile score.
- percentile score.** Number used to express performance on a psychological test in terms of the percentage of a specified sample who attain this level or lower. E.g., a percentile score of 23 separates the bottom 23 percent from the rest of the sample.
- perception.** Organization and interpretation of sensory data, usually in reference to present objects, influenced by previous experience and activity in progress.
- performance.** A person's activities considered in respect to some criterion of accomplishment, such as number of correct responses or quality of output.
- performance test.** An ability test requiring manipulation of objects, with language facility minimized, contrasted with a verbal test; a personality test involving observable behavior, contrasted with an inventory of printed questions.
- personality.** The pattern of traits that characterize an individual's behavior and distinguish this individual from others.
- personality inventory.** A collection of habits, emotions, goals, and similar behavior items descriptive of personality, given to a subject for a report of his customary activities. Also called a **questionnaire**.
- personality trait.** Any consistent characteristic of an individual's behavior. *Common traits*, those that all individuals manifest to some degree, are used for quantitative comparisons, while *individual traits*, those that characterize only one person, require qualitative description.
- personnel psychology.** Division of psychology concerned with the selection, training, and satisfaction of employees and executives.
- phobia.** Extreme fear that persists without sound grounds.
- physical stimulus.** Pattern of energy that impinges on a sense organ and elicits a response.
- physiological cost of work.** Measurements of bodily processes, such as oxygen consumption, during performance of a standard task.
- physiological limit.** Upper limit of attainment in motor learning set by organic capacities.

- physiological psychology.** Division of psychology concerned with the application of physiological methods and principles to the understanding of behavior.
- pitch.** Prominent qualitative dimension of heard sounds, described by such terms as "low" and high," and correlated with the frequency of the physical stimulus.
- polygraph.** Instrument for making several records at once.
- practice.** Repeated performance of an act directed toward improvement. When the performances or trials are spaced out, with rest periods between them, it is called *distributed practice*. When the trials are close together, with little or no rest, it is called *massed practice*.
- prejudice.** Readiness to judge a person or a group before the facts are considered.
- preparation.** The first part of a complex act, making ready; in reference to problem solving, preparation refers to any kind of diagnosis of the problem situation and readiness to produce solutions.
- pressure group.** Organized group that pursues its own goals by attempting to influence others, e.g., school children.
- prestige suggestion.** Acceptance of a communication without critical examination because of respect for the communicator.
- principle.** Statement of a general relationship between events or concepts.
- problem.** A situation to which the individual is motivated to respond but to which his initial response is unrewarding; thus *problem-solving behavior* is characterized by varying series of responses directed toward different aspects of this situation.
- production.** Turning out or emitting anything, such as words, ideas, drawings, solutions to problems, or units of work; hence *productive* refers to this kind of activity in contrast to critical or evaluative activity, and *productivity* is a measure of the amount turned out.
- profile chart.** A display of several scores for one individual graphed on a common scale to facilitate study of the individual.
- projection.** Ascribing one's own traits to others, especially ascribing one's faults to others because of a feeling of guilt about them.
- projective tests.** An unstructured but standard set of materials and instructions administered with the expectation that the subject will project his motives and style of life onto the material and that inferences about these can be made from his responses.
- psychiatry.** A medical specialty concerned with behavior disorders.
- psychoanalysis.** A theory of psychology and a method of psychotherapy, developed by Sigmund Freud, which emphasizes motivational conflict and the development of personality.
- psychodynamics.** Explanation of behavior in terms of motives.
- psychogalvanic reflex.** See **galvanic skin response**.
- psychology.** Science of behavior; systematic study of adjustments of living organisms to their environment.
- psychometrics.** Division of psychology concerned with the development and application of mathematical procedures to psychology; psychological measurement.
- psychopath.** An individual of eccentric personality, not neurotic or psychotic, maladjusted to social norms.
- psychopathology.** Abnormal behavior.

- psychosis.** Disabling mental disorder, characterized by serious difficulties of adjustment and change of personality.
- psychosomatic.** Pertaining to relations between mind and body—more specifically, to emotional factors in medical illness.
- psychotherapy.** Expert treatment of illness by psychological methods.
- pupil.** Opening in the iris, through which light passes to reach the retina.
- pupillary reflex.** Automatic change in the size of the pupil in response to a change in amount of light reaching the eye.
- pursuit movements.** Movements designed to follow the changes of a continuously moving target.
- quantitative psychology.** A psychological specialty which includes psychological measurement, statistical treatment of psychological data, and the construction of mathematical theories of psychological phenomena.
- questionnaire.** See **personality inventory**.
- ranking.** Judging objects or persons by arranging them in order of some magnitude, e.g., size or ability, such that the object of greatest magnitude is ranked 1, and the others follow in descending order.
- rating.** Judging objects or persons by assigning each a location on a rating scale. A *rating scale* is a systematic arrangement of contiguous categories represented by numerals, as 1, 2, 3, 4, 5, or words, as very shy, shy, friendly, very friendly, and a *rating* is a report of the category to which an object or person is assigned.
- rationalization.** Advancing specious reasons to make one's acts appear respectable.
- reasoning.** Solving a problem by logical inference; hence *reasoning ability* refers to success in doing so under standard conditions.
- receptor.** Nerve cell sensitive to a special class of stimuli.
- redundancy.** The extent to which a message or a portion of a message does not add to the receiver's information because it can be predicted from previous portions.
- reflex.** A simple brief act. Unless qualified, e.g., conditioned reflex, this term refers to stable innate stimulus-response correlations.
- reflex method.** Any method which uses a reflex as an indicator, as in testing hearing.
- regressive movement.** Backward movement of the eyes in reading.
- reinforcement.** Strengthening a response to a stimulus, as, in classical conditioning, by presenting the unconditioned stimulus after the conditioned stimulus, and, in operant conditioning, by giving a reward after the conditioned response. Also see **secondary reinforcement** and **intermittent reinforcement**.
- rejection.** A characteristic of interpersonal behavior by one person which indicates that he considers another person worthless. The latter feels that he is not wanted, not respected as an individual. Contrast with **acceptance**.
- relearning.** A measure of retention: The material is learned again and the difference between the relearning time and the original learning time is an index of the amount retained.
- reliability.** Self-consistency of a psychological test, freedom from chance errors. Thus a *reliability coefficient* is a mathematical expression of the reliability of a test. Most reliability coefficients have a range from 1.00, indicating complete self-consistency, down toward zero; hence a test with a reliability coefficient of .50 is hardly worth using.

- repression.** Inhibition of memory, usually as a defense against anxiety connected with the repressed material.
- resistance.** Maintaining repression, during psychoanalysis, by avoiding conversation or free association around ideas that might arouse anxiety.
- response.** Activity of muscles or glands following stimulation.
- response set.** Tendency to make a certain response under certain conditions regardless of the object to which the response is made, e.g., making a high proportion of No responses on a personality inventory.
- response variable.** Some aspect of responses that occurs in varying amounts or degrees.
- retention.** Holding on to what has been learned, the opposite of forgetting.
- retina.** Layer of the eye containing the nerve cells that are sensitive to light.
- retinal disparity.** Difference between the images on the two retinas, resulting from the slightly different angles of the two eyes when viewing a solid object. Normally the two images fuse into a single perception of a solid object.
- reward.** Object, symbol, or condition used as a goal to motivate behavior.
- rigidity.** Inflexibility, tendency to persist in an activity in spite of changing circumstances.
- rod.** Rod-shaped nerve cell in retina, sensitive to very low intensities of light.
- sample.** A limited number of cases, taken for study from a large population, usually with the intent to make inferences about the population. Thus a *representative sample* includes all kinds of cases in the same proportions as the population, and a *biased sample* differs in some respect, e.g., more old people, from the population.
- saturation.** A dimension of color, described by such terms as "colorless" and "colorful." A pure green is highly saturated or colorful; as other colors are mixed with it, it becomes less saturated or less colorful and looks less like green and more like gray.
- schizophrenia.** A group of psychoses, characterized by inconsistency between behavior and emotion and instability in reality relations, especially relations with other people, usually beginning early in life and leading frequently to personality deterioration.
- school psychology.** Division of psychology concerned with the adjustment of the child to the school situation.
- secondary gain.** Advantage of illness to a person, e.g., attention, postponement of decisions.
- secondary reinforcement.** Reinforcement by a stimulus or event that derives its reinforcing effectiveness from previous conditioning.
- selective learning.** Learning some activities, rather than others, in a complex situation, presumably those that are related in some way to the motivation. Also called learning by **trial and error**.
- self concept.** A person's impression or understanding of himself when he views himself as an object of knowledge.
- self-control.** Direction of behavior toward remote or abstract goals consistent with the self concept, and parallel resistance to temporary distractions and frustrations.
- self orientation.** Concentration on one's own feelings and status rather than on the task to be accomplished. See **task orientation**.

- sensation.** Conscious experience, such as warmth, resulting from stimulation of a sense organ.
- sense organ.** Specialized part of the body that collects and responds to a certain kind of stimuli. The sense organ includes accessory parts, such as, in the case of the eye, muscles and lens, as well as the sensitive receptors and neural connections.
- sensory.** Pertaining to a sense or a sense organ.
- sensory adaptation.** Adjustment of sensory mechanisms to continued stimulation.
- sensory nerve.** A nerve that conveys neural impulses from a receptor to the spinal cord or brain.
- set.** Temporary readiness to attend to certain stimuli, rather than others, and to make certain responses, rather than others.
- social approval.** Behavior of others that rewards, or at least does not punish or threaten to punish, the individual's behavior.
- social class.** A division of society which includes people of similar social characteristics, especially income and occupation.
- social distance.** A measure of tolerance for people or groups, expressed in reference to the closeness of social contact, e.g., residence in the neighborhood, that one will permit.
- social group.** A number of individuals who interact with each other.
- social interaction.** Behavior directed toward other people and responsive to others' behavior.
- social norm.** Any socially sanctioned mode of behavior.
- social psychology.** A division of psychology (also a division of sociology) concerned with relations between the individual and the culture, social groups, and other individuals.
- social role.** The part that society expects certain classes of people to play, e.g., mother, student, entertainer, soldier, leader.
- social status.** Position or rank of an individual in reference to a social hierarchy or scale of prestige.
- socialization.** Generalized acquisition by the child of the culture of the adults.
- sociometric methods.** A variety of procedures for measuring the attraction, positive and negative, between the members of a group in terms of choices or ratings and for describing the group structure in such terms.
- somatic.** Pertaining to the body.
- span of immediate memory.** The number of items, such as digits, that can be correctly reproduced immediately after presentation.
- specific hunger.** Drive for a special food substance, often related to a physiological deficit.
- speech-to-noise ratio.** Intensity of speech sounds in relation to intensity of background noise. An important factor in the intelligibility of speech.
- spontaneous recovery.** Recovery from illness without specific treatment.
- standardized test.** A test that has been edited, refined, and administered to identifiable samples, so that test norms are available and the scores can be interpreted with some confidence.
- startle pattern.** Rapid bodily reaction to a strong stimulus.
- stereotype.** Rigid oversimplified concept of the characteristics of a racial, national, or occupational class which biases descriptions of individual members of the class.

- stimulus.** External event that is followed by activity.
- stimulus differentiation.** Narrowing the range of stimuli which elicit a response by reinforcing responses to some stimuli but not others.
- stimulus generalization.** A principle of conditioning: Once a response has been conditioned to a certain stimulus, it is likely to be elicited by similar stimuli.
- stimulus object.** Object in the environment from which physical stimuli come to the organism and to which the organism's activity is related. See **physical stimulus**.
- stimulus variable.** Some aspect of stimuli that occurs in varying amounts or degrees.
- strategy.** A problem-solving process, an identifiable series of responses directed toward solution of a problem.
- subject.** Individual exposed to experimental treatment.
- subjective.** Pertaining to the individual himself; private.
- sublimation.** Substitution of a socially approved goal for a taboo goal.
- substitution.** Any change of goals.
- suggestion.** See **prestige suggestion**.
- superego.** The restrictive influence of social norms and taboos after they have been thoroughly learned and accepted as part of the self concept; the conscience.
- sympathetic division.** A part of the autonomic nervous system, corresponding roughly to the thoracolumbar division, that innervates many internal organs.
- task.** Activity or accomplishment specifically assigned to an individual by himself or others.
- task orientation.** Concentration on completing an assignment or reaching a goal rather than on one's own feelings or status. See **self orientation**.
- test.** Standardized situation from which scores are obtained for comparisons between individuals or between conditions.
- theory.** System of principles or laws capable of explaining many events.
- thinking.** Problem solving; also mental activity, the flow of ideas, memories, hopes, and fears as consciously experienced.
- threshold.** The statistically determined point at which a stimulus is just barely adequate to elicit a specified response (absolute threshold), or at which it differs enough from another stimulus to elicit a different response (difference threshold).
- timbre.** Specific quality of a musical tone, different for different instruments, produced chiefly by overtones.
- transfer of training.** The effect of previous learning on present learning; may be positive or negative.
- transference.** An essential phase of psychoanalysis, consisting of centering on the analyst the affection or hate previously directed toward someone else.
- trial and error.** See **selective learning**.
- unconscious drive.** Activity directed toward a goal but with the usual conscious experience repressed.
- unconscious emotion.** An emotional reaction evidenced by physiological changes and perhaps overt behavior, but with the usual conscious experience repressed.
- validity.** The usefulness of test scores for any specified purpose. *Predictive validity* refers to the effectiveness of the test in predicting a criterion of future performance, such as promotion to a better job. See **criterion**.

value. The worth or priority ascribed to an abstract quality or condition.

verbal. Adjective referring to words. Thus *verbal conditioning* uses words as stimuli or responses; a *verbal test* requires understanding or use of words, as contrasted with performance test.

vestibular. Pertaining to the sense organ of the inner ear, the vestibule, semi-circular canals, and accessory structures, or to their function in perception of position and movement of the head.

vigilance. A set to detect weak signals persisting through periods in which no signals are observed.

visual acuity. Ability to discriminate fine details, such as the space between two parallel bars, measured in terms of minimal separation at a fixed distance or in terms of visual angle.

visual angle. The angle subtended at the eye by a target in the visual field.

vocabulary. A list of words. In respect to individual achievement one's *active vocabulary* is the words he uses and his *passive vocabulary* is the words he understands.

wavelength. Distance between any point of one wave and the corresponding point of the next wave in a rhythmic series. Reciprocally related to frequency. Lights, for example, are described in respect to wavelength, as measured in millimicrons.

Weber's Law. A famous principle of the relativity of sensory acuity, which states: The differential threshold is proportional to the standard stimulus. It holds true in the middle range of most stimulus variables but not at the extremes.

word association. A learned relationship between two words such that, when an individual perceives the first, he is likely, if not otherwise occupied, to recall the second.

work. Sustained activity oriented toward remote or abstract goals, in contrast to reflexes, emotional activities, and activities that are intrinsically rewarding, like goal responses and play.

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